

U.S. Environmental Protection Agency White House Environmental Justice Advisory Council

Public Meeting Summary

Aug. 3–4, 2022

Location: Virtual meeting

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Preface

The White House Environmental Justice Advisory Council (WHEJAC) was established by Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*, issued on January 27, 2021. Hence, the WHEJAC is a non-discretionary committee that operates under the provisions of the Federal Advisory Committee Act (FACA), 5 U.S.C. App. 2.

The duties of the WHEJAC are to provide advice and recommendations to the Chair of the White House Council on Environmental Quality (CEQ) and the White House Environmental Justice Interagency Council (IAC) on a whole-of-government approach to environmental justice, including but not limited to environmental justice in the following areas:

- Climate change mitigation, resilience, and disaster management
- Toxics, pesticides, and pollution reduction in overburdened communities
- Equitable conservation and public lands use
- Tribal and Indigenous issues
- Clean energy transition
- Sustainable infrastructure, including clean water, transportation, and the built environment
- National Environmental Policy Act (NEPA) enforcement and civil rights
- Increasing the Federal Government's efforts to address current and historic environmental injustice

EPA's Office of Environmental Justice (OEJ) maintains summary reports of all WHEJAC meetings, which are available on the WHEJAC website at <https://www.epa.gov/environmentaljustice/white-house-environmental-justice-advisory-council>. All EPA presentation materials for this meeting are available in the public docket. The public docket is accessible at www.regulations.gov/. The public docket number for this meeting is EPA-HQ-OA-2022-0050.

Meeting Summary

The WHEJAC convened via Zoom meeting on Wednesday, August 3, and Thursday, August 4, 2022.

See Appendix A for the Federal Register notice for this meeting; see Appendix B for the meeting agenda.

Wednesday, August 3, 2022

Introductions and Opening Remarks

Victoria Robinson, Designated Federal Officer (DFO), opened the meeting by welcoming participants and sharing protocols for discussion. She noted that public comment will be for members of the public who pre-registered to make comments. Others can submit written comments until August 18, 2022.

An interpreter shared this message in Spanish and explained how to access the Spanish-language interpretation and closed captioning meeting services.

WHEJAC Co-chair Richard Moore said that the WHEJAC was the result of requests made by many in the environmental justice movement who sought to move environmental justice concerns to the highest level of the White House. He thanked WHEJAC members and others who assisted with the creation of the recommendations.

WHEJAC Co-chair Peggy Shepard welcomed attendees and said she was looking forward to hearing comments and solutions from frontline communities that the WHEJAC exists to serve.

WHEJAC Vice Co-chair Catherine Coleman Flowers said she is also looking forward to hearing comments and engaging in discussion.

Roll Call

WHEJAC members present:

LaTricea Adams
Susana Almanza
Jade Begay
Maria Belen Power
Catherine Coleman Flowers
Tom Cormons
Angelo Logan
Maria López-Núñez
Richard Moore
Rachel Morello-Frosch
Juan Parras
Michele Roberts
Ruth Santiago
Nicky Sheats
Peggy Shepard
Carletta Tilousi
Viola Waghiyi
Kyle Whyte
Beverly Wright
Miya Yoshitani

WHEJAC members not present:

Robert Bullard
Jerome Foster II
Kim Havey
Harold Mitchell
Hli Xyooj

Victoria Robinson confirmed a quorum and reminded WHEJAC members that they need to maintain quorum to continue the meeting.

Richard Moore introduced Dr. Jalonnie L. White-Newsome, Senior Director for Environmental Justice, Council on Environmental Quality.

CEQ Remarks

Dr. Jalonne L. White-Newsome, Senior Director for Environmental Justice, Council on Environmental Quality thanked the many people who made it possible for her to do her work, including her family, mentors, and CEQ Chair Brenda Mallory. She thanked past and current members of the WHEJAC and the federal partners who were on the call. She also thanked attending members of the public. Next, she shared a story about what keeps her grounded in environmental justice work, which is the experiences of her elderly parents, who have lived through severe flooding in their home five times in the past two years. Dr. White-Newsome described her parents' experience of seeing cars floating in the streets and of being afraid they were not going to be able to escape their home. Dr. White-Newsome said the experiences of her parents—and of many others—was not just the result of climate change, but also of failed physical and social infrastructure, including failed laws, policies, and practices. She said that each person has their own story, and that she will listen to that story and, more importantly, will work together to create a new ending to the story. She stated that she wants to get the work done and see environmental justice institutionalized throughout the federal government.

Dr. White-Newsome shared her approach to the work, which she described as “The Five Cs.” These are:

1. **Cultivation and care.** Dr. White-Newsome said that relationships are central, and she asked the WHEJAC to accept her offer to reset their relationship with CEQ.
2. **Creativity.** Much of the government's environmental justice work is new, and the administration relies on the WHEJAC for perspectives and advice.
3. **Culture change.** This “C” refers to implementing equitable practices and accountability and to building relationships with communities. She is working to reset and reinvigorate the IAC.
4. **Communication.** Dr. White-Newsome said she wants to be as transparent as possible, and she will give the WHEJAC timelines even if they aren't perfect. She said that improved communication is needed not just between CEQ and the WHEJAC but also between CEQ and the general public. She will work with agency partners to create a system that will allow for timely acknowledgement of and response to comments.
5. **Celebration.** Dr. White-Newsome emphasized that she wants to hear not only about WHEJAC challenges, but also about what's going well. It's important to celebrate victories, she said, however small.

Dr. White-Newsome then shared the following updates:

- **Justice40 Initiative:** Agencies have been releasing information about covered programs on an ongoing basis, and these releases will continue.
- **Environmental Justice Scorecard:** There is a public Request for Information in the Federal Register asking for thoughts on the scorecard vision and what should be included in the scorecard. In addition, because agencies will be the ones implementing the scorecard, CEQ will be working closely with the IAC to collect their input.
- **Climate and Economic Justice Screening Tool:** The beta version of the tool is out. They are refining it and will likely release version 1.0 in the late summer or early fall 2022.
- **Executive Order 12898:** The work is ongoing.
- **White house Environmental Justice Interagency Council:** CEQ is working to empower and strengthen the IAC.

Dr. White-Newsome concluded by saying that she wants to be able to tell a story about how, through partnership, policy, and practices, they protected those who had been made most vulnerable by failing systems and structures. She voiced her commitment to working with the WHEJAC to make the Five Cs a reality.

Richard Moore opened floor for questions from WHEJAC members.

Ruth Santiago thanked Dr. White-Newsome for her inspiring message. She said environmental groups in Puerto Rico have been trying very hard to get information from federal agencies, particularly the Federal Emergency Management Agency (FEMA). She said that, regarding recommendations the WHEJAC made last year about distributed renewable energy and using disaster recovery funds for rooftop solar in Puerto Rico, she received a response which consisted of links to a couple of websites, rather than a response to the question of how FEMA is planning on using the historic funding.

Dr. Jalonne White-Newsome asked Ruth Santiago to share the communication for her follow-up.

LaTricia Adams said the WHEJAC is looking forward to more frequent updates on progress as well as CEQ's closer adherence to timelines.

Beverly Wright said she is looking forward to having discussions about difficult challenges regarding the toolkit and scorecard. She said she doesn't expect miracles, but she expects honest and earnest work. She reminded Dr. White-Newsome that WHEJAC members have to go back to real people and explain to them what they are able to do—and what they're unable to do and why. She said the ship is rocking, and the WHEJAC is looking for a real, earnest, hardworking partner to go with them through the ups and downs. **Dr. Jalonne White-Newsome** said she's ready to rock with the group.

Peggy Shepard said she appreciated the remarks, particularly those about creativity and culture change. She said it's important in government work to think outside the box, especially when the government is trying to do something that hasn't been done before. Regarding culture change, Peggy Shepard said the WHEJAC is eager to communicate to their cities and states the investments and benefits they are entitled to. She said she would like to see a true partnership and collaboration, and that the WHEJAC is looking forward to working with them.

Nicky Sheats told Dr. Jalonne White-Newsome that he is looking forward to working together.

Juan Parras said he would like to see meetings with regional EPA leaders throughout the country. He noted that he only knows what's happening in his region.

Dr. Jalonne White-Newsome said she appreciated the welcome and all that was shared. She said there is a lot of work to do, and she knows they can make it better together.

Carbon Management and Justice40

Presenters

Shalanda H. Baker, Secretarial Advisor on Equity and Director of the Office of Economic Impact and Diversity, U.S. Department of Energy

Jennifer Wilcox, Principal Deputy Assistant Secretary, Office of Fossil Energy and Carbon Management, U.S. Department of Energy

Noah Deich, Deputy Assistant Secretary, Office of Carbon Management, U.S. Department of Energy

Holly Buck, Management and Program Analyst, Office of Carbon Management, U.S. Department of Energy

Shalanda Baker thanked CEQ, members of WHEJAC, and her colleagues. She said the topic of the presentation is to share DOE's approach to J40, in particular carbon capture and storage (CCS), as well as other programs under the carbon management umbrella, such as hydrogen.

Shalanda Baker gave some background on the White House Justice40 Initiative (J40) and its goal of ensuring that 40 percent of overall benefit from federal investments flow to disadvantaged communities. She said U.S. Department of Energy (DOE) has more than 140 programs covered by J40. She noted that she emailed every member of the WHEJAC with that historic announcement. In addition, she pointed to the DOE website that has a suite of tools, including a map of disadvantaged communities as well as case studies of state initiatives to target disadvantaged communities (<https://www.energy.gov/diversity/justice40-initiative/>.) She said the website also holds a framework for thinking about J40 implementation, although the final word will be in the released funding opportunities. Part of the general guidance includes stakeholder engagement. She said there is also an "environmental justice explainer" that discusses the complexities of development, as well as a fact sheet, among other resources. Finally, Shalanda Baker said DOE will soon release a few pages on highlights from J40-covered programs.

Shalanda Baker said that last July OMB issued guidance on J40, which indicated what programs and other types of federal investment would fall under J40. She said the guidance language in memo 2128 is what DOE uses to determine whether a program belongs under the J40 umbrella. This language states that a federal government program falls under J40 if it makes investments in on or more of the following seven areas:

- Climate change
- Clean energy and energy efficiency
- Clean transportation
- Affordable and sustainable housing
- Training and workforce development
- Remediation and reduction of legacy pollution
- Critical clean water and waste infrastructure

She iterated that whether a program is covered by J40-covered is not determined by whether any program already directs benefits toward a disadvantaged community. Instead, if a program investment falls under at least one of the areas above, then programs *must* figure out how to get at least 40 percent of its benefits to disadvantaged communities.

Shalanda Baker explained that programs that are unpopular with environmental justice communities nevertheless need to be under the J40 umbrella in order to ensure that benefits reach communities and that these programs are not exacerbating harms. She said including these programs under the J40 umbrella allows DOE to do something historic and transformative in communities that have been left behind.

Shalanda Baker shared information about the “Find your Program” part of the DOE website, as well as the EJ Explainer and the J40 Fact Sheet. She said that DOE’s eight core policy priorities can be found on the website, as well. She said the Disadvantaged Community Reporter part of the website allows a user to click on a geographic area to understand where it ranks according to the DOE’s 36 indicators of disadvantaged communities.

She said that, as of July, DOE has 144 programs in 23 program offices covered under J40. She said most DOE programs established under the Bipartisan Infrastructure Law (BIL) are also covered by J40, and these include research and development programs, as well as new infrastructure programs. She said DOE is a leader across the federal family in J40-covered programs. She noted that they have an opportunity to push all of the BIL’s \$62 billion through the J40 filter. She iterated DOE’s commitment to environmental justice and the potential of J40. She said she looks forward to partnering with the WHEJAC to lift up justice in every way.

Noah Deich said he hopes it’s the first of many conversations with the WHEJAC. He said he was in attendance to discuss the carbon management provisions of the BIL. He said they at DOE have all read the WHEJAC report that states CCS projects will not benefit communities. However, he noted, Congress has given DOE tens of billions of dollars to fund those types of programs.

Noah Deich said “carbon management” refers to a suite of activities involving carbon capture, use, transport, and storage. He said the BIL provides for more than \$12 billion in funding to be spent over a 5-year period (largely through grants) on all of these activities. He said DOE tends to fund projects that are at the stage in which they are beyond a successful science experiment but not yet commercially ready. The DOE funding mechanism is typically a grant with a cost-share from the industry partner. He said Congress has specified the types of projects that can and cannot be funded with BIL monies. For example, \$2.5 billion is allotted for CCS demonstration projects. A minimum of six demonstration projects must be funded in existing industries, with a minimum of two grants going to coal, two to natural gas, and two to heavy industry. There is also a \$3.5 billion provision for four full-scale direct air capture pumps. Noah Deich said CO2 transportation and storage has similar funding. There is \$8 billion set aside for hydrogen hubs.

This funding support will mean that we will go from zero operational CCS projects to about a dozen, and we will greatly expand the amount of CO2 storage capacity, from a handful today to a hundred or more.

Noah Deich also shared how DOE is thinking about funding. He said EPA asks applicants about how they think about technology and also what they’re doing to engage with communities. He said DOE then makes agreements with funded entities about what they have to do to receive funding, to ensure attention not only to the technical dimensions, but to the social dimensions, as well.

Holly Buck acknowledged the questions people have about CCS, such as how it will be used, its risks to safety, accountability and liability should something go wrong, as well as how much is known about CCS and alternative models, among others. She noted the importance of assessing the entire lifecycle of these projects and their environmental and social impacts. She referred to the WHEJAC’s prior recommendations, which highlighted stakeholder engagement and the need for funded projects to meet environmental justice criteria.

Holly Buck said that, with these and other concerns in mind, DOE had developed a package of requirements for new projects. She mentioned two recent funding opportunity announcements that integrated social considerations of impacts criteria.¹ She said that applicants and awardees are required to have a Diversity, Equity, Inclusions, and Accessibility (DEIA) Plan, a J40 Plan, a Community Stakeholder Engagement Plan, and a Quality Jobs Plan. Merit review criteria will explain how the components will be scored, and guidance documents help applicants understand what DOE is asking for.

Holly Buck said the Department is grappling with bigger questions such as “How do we achieve not only distributive and procedural justice, but also make progress on restorative and recognition justice?” and “How do we move from affirmations of importance and quantitative assessment to action?” She said that it will be important for teams to not get stuck after the assessment phase because it fits their existing expertise, but instead move into developing goals, outcomes, and time-based implementation plans.

Regarding the J40 Plan, Holly Buck said that components include not just an assessment of impacted communities and project benefits, but also of harms and other impacts not included under “benefits.” J40 Plans will also have to include an implementation strategy with milestones and timelines, as risk assessments.

The Community Engagement Plan also has several components, including a social characterization assessment to understand community history and dynamics; a stakeholder analysis that maps who will be engaged; an engagement methods and timeline; a two-way engagement statement on how the project will incorporate consent-based siting; a project agreements statement that describes plans to negotiate a community benefits/good neighbor agreement; and an engagement evaluation strategy to let projects know if community needs are being met.

The DEIA Plan intends to foster a welcoming and inclusive environment, supporting people from groups underrepresented in STEM or other workforces, advancing equity. This plan also includes milestones and timelines and the resources the project will dedicate to implementing the plan, such as staff, facilities, capabilities, and budget.

Holly Buck said that, to score the plans, DOE will be looking for criteria such as level of detail, measurable actions, community partnerships and clear community support, and whether these efforts are integrated into the project rather than being siloed, among other criteria.

Finally, Holly Buck shared DOE’s opportunities to oversee progress at various points in the process, beginning with scoring the applications. During award, funded entities need to refine and resubmit their plans within 90 days. DOE will help with that to make sure plans are up to their standards. Other milestones will have to be met during implementation, and at the end of the project, there will be a final report.

She said there is more information to be found at <https://www.energy.gov/FECM/resources/>.

Richard Moore thanked the presenters and remarked that one injustice cannot be remedied with another injustice. He added that accountability for ensuring that communities are genuinely engaged is crucial. He noted that some states are already figuring out how to use Justice40 funds to increase injustice. He then opened the floor for questions.

Beverly Wright asked how DOE will determine if the 12 CCS projects to be funded would harm the same communities already harmed by oil and gas companies. She asked how they will determine the

¹ These were DE-FOA-0002610 and DE-FOA-0002614.

probability of success. She said her people are the canaries in the mine. She also asked about proximity to communities already overburdened by pollution. What are the safeguards? Will they yield reduction in CO₂ without harming the environment? She asked, from the point of view of a taxpayer, if the dollars invested in these experiences will result in a reduction in carbon dioxide without harming the environment or killing people.

Noah Deich said that DOE is thinking of asking applicants for two sets of data: One on greenhouse gas emissions and sequestration data across the full lifecycle of the process, the other set on non-greenhouse gas environmental data; that is, the impacts to air, water, soil, and so on. He said that DOE has posted notices of intents and is drafting the final funding opportunities, which will include language about what is required. The final technical criteria are not in the slides because they have not been released yet.

Beverly Wright followed up with a question on who will be on review committees.

Holly Buck answered that review is done by the federal government but can also be include volunteer experts in the field.

Viola Waghiyi asked Shalanda Baker who will hold the military accountable for toxics. She said there are 9,000 formerly used defense sites in the nation; the two on her island have caused a cancer crisis. Viola Waghiyi told Noah Deich that carbon management is false solution. Indigenous peoples of the Arctic have experienced extreme weather. Ice is melting and wildlife is becoming extinct. She asked whether CCS would harm the land and what products will be made with fossil fuel. Finally, Viola Waghiyi asked Holly Buck if DOE has consulted with the 229 tribes in Alaska. She said that communities are falling into the Bering Sea and they have never been offered moving assistance.

Shalanda Baker replied that she does not have oversight into EPA programs, but they can get an answer on DOE-specific questions. She said DOE has their own set of legacy pollution programs that fall under the Justice40 umbrella. She said that for the 144 programs they have at DOE, they are also focused on legacy pollution but that does not necessarily intersect with the communities Viola Waghiyi is referring to.

Noah Deich said they do have data on how these solutions can work for climate and environmental protection, but it is not fait accompli that they will be deployed in that way. He said he would like to invite anyone who is interested in learning about the technical details to further conversation.

Because time for the discussion was running out and several WHEJAC members had their hands raised, **Richard Moore** asked **Shalanda Baker** for a commitment that DOE will respond to written questions from the WHEJAC. She agreed, so Richard Moore asked members to ask their questions for the record.

Michele Roberts asked, given that there have been severe flaws in modeling, what is the process to make sure the model is correct and externalities are factored in. Also, if externalities are not factored in, what does that mean for the project? She also wanted to hear about the process for engaging communities around a communities' benefits agreement to make communities whole.

Maria López-Núñez said that communities should not be experimented with. She said there are no amount of guardrails adequate to protect communities from unstable technologies. Regarding the use of CO₂ for transportation, she would want the models prepared by people they trust. She said the Department's close relationship with the fossil fuel industry breed distrust. She said to Shalanda Baker that she understands why carbon experimentation is a part of Justice40, but DOE must define benefits very tightly. She said communities need to be educated about the dangers, and she is not hearing that in the presentations. She does not want communities to be offered jobs in which they participate in

their own destruction. She also questioned the ease of state permitting processes. She said she wants to understand better how DOE will say no to a project if the community says no to a project.

Miya Yoshitani said she has heard questions such as whether the technologies will add more harm to overburdened communities and whether the technologies are harmful in other ways, but she did not hear the answers to these questions. She said her fundamental question is why DOE would roll out a \$12 billion grant program before they had answered those questions. She also asked where the transparent public process was to answer those questions before the technologies are allowed to move forward. She wanted to know the process for denying grants, who has the burden of proof for harms, and how transparent the process is.

Nicky Sheats said he would prefer not to have CCS in Justice40. He asked whether projects that communities do not support would be halted.

LaTricea Adams said the presentation seemed performative and disingenuous. She said it was uncomfortable to see WHEJAC recommendations juxtaposed with something that could potentially cause harm. She said that a core message from the WHEJAC is that nothing that would be considered a benefit would be harmful. She referred to the history of carbon removal and asked what DOE will do to address manmade ills.

In the chat box, **Jennifer Wilcox** shared the following link to Notices of Intent for carbon management efforts:

<https://oced-exchange.energy.gov/Default.aspx#Foald3ec25bcf-a385-4b5a-87d2-2a0b8fa4ca5a>

Shalanda Baker thanked the group and said she does not believe conversations of this nature would have been possible if the carbon management portfolio were not under Justice40. She said the Justice40 framework allows for a close look at all the technologies. Regarding the comment about the presentation being performative, Shalanda Baker said that it is an authentic beginning of a conversations. She said she will share DOE's responses in writing.

Break

Public Comment

Victoria Robinson reminded attendees that the deadline to register to speak was Wednesday, July 27, at 11:59 p.m. She said they will continue to accept written comments through Thursday, August 18.

WHEJAC Co-chair Richard Moore said that in addition to comments about the scorecard, the WHEJAC welcomes comments for CEQ and IAC. He said that, regardless of when a person signed up, the WHEJAC prioritizes hearing from individuals who they have not heard from in the past.

Azania Heyward James, public commenter: Good afternoon to all of the panelists, all of the speakers. I'm very excited about the Justice40 Initiative. And I'm speaking to you from the Maryland area, yet working with a collaborative across the southeast. And so, the question that I bring to you today, with all of the wonderful attributes of the Justice40 initiative, I'm very interested in the metrics of it, as well as the reporting. So, one of the things is that with our communities, it's very intergenerational, from grandmothers from 93 to the baby's zero, all of them are affected by the actions of systemic and historical environmental injustices and inequities. And so, we're looking forward to hearing the reporting out in real time, in terms of a scorecard. So, as you initiate all of these wonderful activities, we want to know like what is happening in terms of impact—and with the numbers in a digestible way that everyday community people most impacted can understand it. I don't know if that's in the plan, so my recommendation, as requested, is that there be a digestible type of scorecard template that can be shared with our constituents with boots on the ground. Thank you.

Theodora Scarato, public commenter: My name is Theodora Scarato. I'm Executive Director of Environmental Health Trust, and I'm recommending that the environmental justice scorecard include not only harms in regards to climate toxins and pesticides, but also non-ionizing electromagnetic radiation and wireless radio frequency radiation, be it from phones, cell towers, or the over 800,000 new small cells that industry claims are needed for 5G. The greenwashing of 5G and the myth that it will somehow bridge the digital divide is fueling the fast tracking of new wireless networks despite the fact that research shows wireless network proliferation, one, is rapidly increasing energy use; two, is unsustainable when you calculate the embodied energy mineral mining communities polluted from the manufacturing, the soaring leukemia rate in semiconductor plant workers; and three, 5G will likely as the GAO report recently stated, exacerbate the digital divide; and four, 5G poses health and human environmental, serious health and environmental risks. EHT, our organization, recently won in the DC Circuit a case against the FCC regarding the lack of adequate review of the FCC's 1996 wireless radiation safety limits. The FCC was found to have ignored record evidence, such as research linking exposure to damage to memory, sperm, DNA damage, and harm to trees and pollinators. So, there are many studies also finding synergistic effects when you combine radio frequency with other toxic exposures such as lead and black carbon. We're contacted by people nationwide who live in low-income housing where cell towers and cell antennas are being mounted in front of apartment bedroom windows or on their apartment buildings. Communities are being cut out of the decision making process and people are told there is nothing they can do. There's a story of a young man who contacted me—the antenna was literally two feet from where his head rested on his pillow. Longstanding healthcare inequities will further exacerbate the harm. Communities are already overburdened with environmental exposures to chemicals, heavy metals, and air pollution. And now we have the added burden of increasing radio frequency adding to the daily cumulative toxic exposure. Now radio frequency is defined as a type of pollution by the wireless companies themselves in their phone insurance plans. They even warn shareholders of the financial risk from radio frequency lawsuits related to health damages, but they do not warn the people who live near the cell towers. A Journal of the National Cancer Institute penned by experts including the former director of the National Institute of Environmental Health Sciences, Dr. Linda Birnbaum, Yale OBGYN chief Dr. Hugh Taylor, concludes DNA damage and cancer in the state-of-the-art studies signaled the need for the public to reduce exposures to radiofrequency now. Thank you.

Jennifer Hamad, public commenter: Good afternoon, Whitehouse Environmental Justice Advisory Council. My name is Jennifer Hamad, and I'm a current undergrad at Stanford University and an avid environmental justice and climate activist and researcher. For the past two years, I've done extensive research into the harrowing water lead crisis in the U.S. that continues to place the health of approximately 36.5 million or 50% of all American children at risk, according to Vice President Harris, who declared water lead contamination and national emergency. Research, including my own, have elucidated the extensiveness and severity of the current water lead crisis and the disproportionate effect it has had on low-income communities of color. Thus, not only is lead water contamination a public health crisis, but an issue of classism and racism, as well. Although no amount of lead exposure is deemed safe, and even small amounts of lead exposure have been attributed to brain damage, gastrointestinal, reproductive, and renal problems, behavioral issues, hearing impairment, and anemia—according to the American Academy of Pediatrics—water lead contamination remains unregulated in 80% of American public schools under the current lead and copper rule. According to a study put out by the U.S. Government Accountability Office in 2018, of the 43% of school districts that tested their water, already 37% found water lead levels above the 15 parts per billion actionable limit.

Water lead contamination in American Public Schools is widespread and severe. Despite the 2021 revisions to the lead and copper rule, it remains anemic and lacks the ambition needed to eliminate this environmental justice and public health issue. The revised lead and copper rule will only require testing of approximately 20% of public schools and childcare facilities served by water systems and will maintain the 15 parts per billion as the actual water lead level triggering lead service line replacement. Thus, so

long as children are ingesting below 15 parts per billion of lead their water is treated as safe. In this way, current legislation fundamentally fails to protect children across the nation from toxic lead exposure. Until the water lead crisis in the U.S. is ameliorated, our agencies will not successfully achieve the environmental justice goal of providing safe drinking water to the American people. This is why it is imperative that the issue be a priority to the White House Environmental Justice Advisory Council and be a focus on the environmental justice scorecard. In order to measure the progress of our nation in addressing the water lead crisis, we must monitor water lead contamination and blood lead level data across the nation in correlation with socioeconomic and racial data in the environmental justice scorecard. Monitoring blood lead level data in this way will allow our agencies to determine the effectiveness of future investments made and to not only eliminating water lead contamination but achieving environmental justice and equity in health and safety. I also call upon our agencies to consider investing in expansion of lead surveillance in public schools and the development of a robust and expeditious remediation plan to eliminate lead exposure when any amount of water lead contamination is detected in our communities. Thank you so much.

Danyelle Holmes, public commenter: Good afternoon, White House Environmental Justice Advisory Council and all participants. My name is Danyelle Holmes. I'm national social justice organizer with [inaudible] and Poor People's Campaign, a National Call for Moral Revival, and a steering committee member of the Mississippi Rapid Response Coalition. I'm an organizer, mother, and longtime resident of Jackson, Mississippi. I have worked throughout the U.S., mainly in the south, the state of Mississippi, and the city of Jackson, lifting the needs of people in our communities that have been most impacted by harmful government policies, crumbling infrastructure, and economic underinvestment. I am a Jacksonian; I love the city, this place, and the people. The Poor People's Campaign, a National Call for Moral Revival, brings people together to confront the interlocking evils of systemic racism, poverty, ecological devastation, militarism and the war economy, and distorted moral narrative of religious nationalism. The Mississippi Rapid Response Coalition mobilizes community members across Mississippi to provide rapid response support in times of crisis caused by natural disasters or infrastructure failures. The problem and proposed solution today: cities across the United States are struggling to rebuild their crumbling pipes, roads, and bridges. Jackson Mississippi is no different. What exasperates our issues in Jackson is racism, classism, a state government willfully participating in environmental neglect, and a state government committed to divesting resources from the capital city, which they find to be black.

Jackson is the capital city of Mississippi. It is one of the oldest cities in the state. It is the largest city in Mississippi by three with over 150,000 residents. More than 80% of the population of Jackson is black and/or people of color. Twenty-four percent of the population lives below the poverty line. The first black mayor of Jackson was elected in 1987, and the city has been under black leadership ever since. Nearly every year, black government leadership in Mississippi petitions the state for support to rebuild its decades-old piping and water treatment facility. Every year, little to no money is provided to adequately fix the problem. As a result, the city is forced to work miracles with a water plant that is in a fragile state, while residents are routinely required to boil our water when the plant is being repaired—which is often because it is old—or when there's a leak or severe storm that may have caused contaminants. Communities around Jackson, communities with water infrastructures that began to sprout up after the great white flight out of Jackson, post the election of the first black mayor in 1997, have newer water systems, pipes, and etc. Jackson, the oldest major city and capital of the state, should and could have a newer water system with proper state investment.

As residents of Jackson, we have tried to take matters into our own hands and fix the problem by taxing ourselves an additional 1 percent sales tax, which will be used specifically for water infrastructure needs. However, the state government has limited our ability to adequately leverage these funds, despite us passing the 1 percent sales tax. Moreover, even with additional taxation, our water problems are so old and complicated that millions raised by the extra tax will only cover a small portion of the billion-dollar water infrastructure issue. It's important to note that these problems have existed since many of us

were children. I have friends in Jackson that recall being required to boil water and the early 1990s, when the city was under white leadership. Not only is the problem one of intentionally not wanting to support elements and good quality of life for a predominantly black city, but it's also the state's neglect to prioritize water security and infrastructure development overall. In 2021, Jackson communities experienced an arctic blast that left 60,000 residents without electricity, water, and food. Nearly 130 pipes burst across the city of Jackson. Highways were closed to traffic coming in and going outside of Jackson. In response, residents of Jackson and rural communities immediately, two days following the winter storm, began to mobilize to take care of each other, providing food, water, and kerosene to families. The Mississippi Rapid Response Coalition served over 55,000 people and provided resources to 30 groups to distribute additional resources to their communities. The governor, however, waited three weeks before he even called for a state of emergency, leaving cities like Jackson and other rural communities to fend for themselves. The time for state government failure is over. It is time for the state to fully fund Jackson's billion-dollar water infrastructure issues. The problems have existed for decades and will not disappear. It is time that EPA works with Jackson leadership to fix this problem, not to exacerbate it. This can happen by the EPA and the state providing every resident with a water filter that can be utilized, even during water requirements. Fixing the fragile, very old water plant in Jackson is going to take time; we need interventions that keep water drinkable in the meantime. This problem can also begin to be solved by the EPA and the state working with Jackson to develop an economic plan that will provide funding to completely rebuild Jackson's water infrastructure over a specific period of time without additional cost to the city or its residents. It is past time that the state fully invest in Jackson.

Joy Davis, public commenter: Thank you so much. One of the biggest issues I see when it comes to combating and confronting environmental racism that impacts us the most is many people in organizations—not all of them—leading these efforts do not live in cancer clusters, communities where public dumping is happening, and housing complexes or facilities that have been built or are in the process of being built on toxic sites. Nor do they have their residences tested for radon without being told why or what the results were, like us. It's extremely difficult sometimes giving this important information to actual public members who aren't a part of any groups or organizations. And so, I would like to see a scorecard that contains how underrepresented and historically marginalized communities have been included. Someone I did know was kind enough to forward this information to me, and how we can make sure even more diverse voices from our communities are included. I would like to see a scorecard that contains if grants and funding are making this way and are being allocated to those communities that have been historically harmed and directly impacted by environmental racism. Most of the time, you could just look at the zip code and see where all of those reports are coming in. Having remediation that's actually done. I've seen where people are, you know, where organizations--where companies say that they've done remediation, they are being billed as if work is being completed, but not one piece of grass has been touched. I would like to see a scorecard about the diversity and inclusion and hiring practices and those in supervisory or managerial positions. A scorecard that repeats how repeat violators are being dealt with as far as fines, penalties, and more. Their companies are consistently violating the law and are rarely punished. Sometimes the agencies that are meant to oversee and help regulate these agencies do the complete opposite. Valero is constantly seeking to increase hydrogen cyanide emissions in my city. I would like to see radon levels reported which is odorless, toxic, and causes lung cancer. And I believe that's going to be very eye opening as to the locations that are going to be impacted, the families that are going to be impacted, because we hear about lead, we hear about pollution, we hear about all of this, but radon is going to be something that really needs to be tracked. And thank you so much for your time.

Richard Mabion, public commenter: First of all, good afternoon, everyone. It's really been a pleasure to sit here and listen to you as an organization, communicate and work as you have been doing. What I'd like to address is the need for more research on the creation of retrofitting job training, and employment opportunities for low-income residents in the inner city and rural communities. It is a

known fact that every home and building in America needs to be retrofitted for energy efficiency reasons. While there are already ongoing attempts to fulfill the retrofitting needs, purposely training members of the low-income community for those jobs is not seen as a preferred method of achieving those two goals or objectives. Brookings Institute recently shared two articles that support the need for additional research on low-income employment possibilities. The first one addressed that June's 2022 job report showed a warning for social engineers regarding workers of color in America. The second article addressed the study of how job displacement affects blacks, women, and non-degreed individuals the most. So, my recommendation for the for the WHEJAC is I would like for you to let the White House Council on Environmental Quality know that we social engineers out here—boots on the ground, in the field—need their help in securing your research—serious research—that deals with the low-income inner city and rural employment situation. Thank you.

Rodney Cawston, public commenter: Thank you. My name is Rodney Cawston and I'm a member of the Confederated Tribes of the Colville reservation. The Confederated Tribes of the Colville Indian reservation is located in north central Washington state. Our reservation is located within two counties that have the highest rates of poverty and unemployment in the state of Washington. Many efforts for economic development have not been successful to support our tribal government or to provide necessary resources to our membership. Twelve tribes were relocated on to the Kabul reservation, from far north into British Columbia, and as far south to Oregon and Idaho. These 12 tribes bring a great diversity to our reservation. But it also brings challenges when developing cultural programs, curriculum development, or for language learning programs. Our reservation is 1.4 million acres which includes two mountain passes. This is also a rural remote part of Washington State. The geographic distance across our reservation for transportation, emergency services, broadband, and cellular access for communication places us in a huge disadvantage. Also, these challenges translate with higher cost to provide services. Our children have an unequal access to education. The children of our school districts have the lowest standardized test scores in the state of Washington. The tardiness of our children is over 40% of the student population on any given day at one of our schools attended by our children. Approximately 70 to 80 percent of our reservation is not covered by broadband or cellular service. During the COVID pandemic, the Colville reservation experienced many problems. Children did not have access to the internet to receive curriculum assignments or to turn their homework back to the schools. Many schools lost contact with children altogether. We learned of parents who drove around their communities with their cell phones in an attempt to download their children's assignments. Our tribe's employees could not participate with telework. Additionally, many of our tribal clinics could not engage their patients with telemedicine. The Colville tribal government is largely responsible to provide governmental programs and infrastructural development. The Colville reservation is a poster child for climate change, and 2015, five wildland fire started during high winds which destroyed over 80 homes and burned over 200,000 acres on the Colville Indian Reservation. And this has this included the death of a one-year-old child we have lost approximately 30 percent of our commercial forests to wildland fires. Logging is the major industry which provides jobs and revenue to the Colville reservation. One of the greatest injustices is to our people is the loss of salmon above Grand Coulee Dam. Grand Coulee and other hydroelectric dams have generated billions of dollars for the federal government. Along with power production, dams on the Columbia River have provided flood control, widespread agriculture, transportation, and recreation. Extraction of water continues today with little to no consideration to the native people who live here, including restoring salmon runs back to the upper Columbia River. What could an environmental justice scorecard be? An increase of our school-aged children's test scores on the Colville reservation, an improvement of tardiness rates of school-aged children, increased broadband access, and reintroduction of salmon above Grand Coulee Dam. It's very exciting to hear of this initiative, and I thank you for this time for allowing me to share some of the conditions that we experienced here on the Colville reservation in Washington State. Thank you.

Myrna Conty, public commenter: Hi, my name is Myrna Conty; I'm from Puerto Rico. I'm an environmentalist and president of [inaudible]. And I wanted to explain the most environmental injustice

in Puerto Rico. We have many environmental justice issues in Puerto Rico. And mainly, we're working with the energy issues because after Hurricane Maria, we were so many months—in some areas a whole year—without electricity. So, we're concerned that the government in Puerto Rico wants to transform the main energy plants to continue using fossil fuels. I'm also part of a group called Queremos Sol, which is We Want Sun, and we have a proposal for the government to try to impose the solar rooftops because we're in the tropics, we have a lot of sun. And we don't have any fossil fuels here in Puerto Rico. So we should use the resources we have, which is the sun. And our main concern is that we don't have any, especially the communities that live close to these plants are poor communities. They have been contaminated with the burning of these fossil fuels with the emissions. They have—most of the communities don't even understand what's really happening till they start getting sick, and they're concerned, and then people reach out to get educated about the information. And we would like for more—our recommendation would be for—it's very important that the environmental issues in Puerto Rico are taken into consideration and especially Latin communities be informed. It's important that that happens because it's sad to hear when these people started getting sick and start dying because of all the contaminations around them. So that would be—and it's important for it to be communicated to these communities. Most people don't have internet access. So it'd be hard for them to be in contact with this kind of assessment. We have to understand how they could get help. So, it's important that the fossil fuel industry will not be continued using Puerto Rico; we should use the sun for our energy system. Thank you.

Sary Rosario, public commenter: Thank you. Okay, good afternoon and greetings to all. God bless you and thank you for this opportunity. I am Reverend Sary Rosario from the faith community of El Puente [inaudible] and I am a pastor from the Christian church Disciples of Christ in Puerto Rico. As Myrna said, we have many environmental injustices in Puerto Rico. In August 2019, we got a [inaudible] of the construction of New Fortress Energy, liquefied natural gas facilities without Environmental Impact Statements and without the Federal Energy Regulatory Commission (FERC) permit. Their community did not know about this project and the local government did not celebrate public hearings. New Fortress Energy represents three major concerns to our community. First, security, we are at risk of an explosion by an [inaudible] accident. The facility is 400 feet near the houses the Semana community houses, and the experts have oriented us that an explosion from the MLG tanker or in the gas pipeline can affect until two miles of distance. Second, the methane gas production of electricity produced contaminants that affects our health. And third, the combustion of methane gas increases the contamination and increases the effects of climate change. For example, I have asthma because I used to live near that place. Some of the churches, their pastors, and a religious organization named [inaudible] sent a letter in March 2020 to FERC requesting a revision why New Fortress has got the permit. They answer one year later that New Fortress must ask for permits and regulations. New Fortress appealed that decision of this federal commission to the court of district of appeals in Washington, DC. This summer, we received the good news that the D.C. Court of Appeals denied New Fortress their petition to build without a permit. But again, in 2022, this year, the pastors and the community wrote another letter to FERC. This time because of the plant of the U.S. Corps of Engineers for dredging the San Juan Bay for the entrance of bigger liquefied natural gas tankers. We need that the funds from FEMA for the electric system will be used in rooftop solar and battery system and not have gas no more. FEMA needs to improve their recovery approach to Puerto Rico especially in the electric system funds, and also in eliminating the requirements of the 10% for projects that, for example, in small churches cannot be complete across the island. Many times the small churches are the ones that are beside the community in this environmental struggle. We need action, and we need agencies like EPA and FEMA to help our communities in advocating in the US Corps of Engineers' plan to not proceed with this dredging in the way and propose that they have it now. We need that New Fortress cannot operate no more because they are in the principal part of Puerto Rico and the Caribbean and if an explosion occurs, they not only affect two miles but affect the distribution of food and many things in Puerto Rico and in the Caribbean. We are so concerned, and we are so grateful for this opportunity that our voices can be heard. Thank you so much.

Bronson Azama, public commenter: Aloha mai kakou. My name is Bronson Azama. I'm speaking to you today from the illegally occupied or—really not on behalf of anyone. I cannot speak on behalf in that sense. But I'm just coming from the perspectives of a Hawaiian Kingdom subject under illegal usurpation of our islands, of our former nation state, which is now under illegal usurpation known as the state of Hawaii. One of the things that we are—that I would like to bring to the forefront is that when it comes to our islands and what's being faced, there's been a specific issue with the Red Hill issue. It's a symptom of the larger. Understanding when we're talking about environmental justice, you know, this is the worst case of ecocide, I think, in terms of the real death of our island. Our sole source aquifers contaminated as a result of the United States Navy's Red Hill bulk fuel storage facilities in which they continue to lie about our drinking water being safe. And this is an issue that's going to face way beyond the next seven generations to mediate. And the worst part of all of this is, again, it's a symptom of the root of the problem being the illegal usurpation of our lands. I really hope that the White House Environmental Justice Advisory Committee can really bring to attention to the President and to different organizations, the need to hold not only the navy accountable, but to hold the whole entire federal level accountable. Because there has been no treaty. There has been no method in which our lands have been legally conveyed to the United States to even allow this using of our lands that has led to the poisoning of the United States service members own children. You know, this ecocide has led to the genocide of—the United States committing genocide even on Americans, not only our people of Hawaii, but your own service members. And it's heartbreaking because despite 129 years of illegal usurpation of our lands, of our kingdom, we're the ones who are advocating for restitution for these families from the very agencies that have conducted the usurpation when the United States Marines illegally landed to overthrow our queen illegally, without presidential consent, on January 17, 1893. And here we are today, fighting for your own soldiers' children's children in order to find them justice, too. And you know, this is part of when it comes to even these federal policies and the jurisdictions of the matter. We need to investigate to all of these land jurisdictions and also find some sort of restitution and reparations for other crimes that have been committed, with no legal jurisdiction over our islands as well as various other indigenous groups across the Americas. Mahalo.

Sofia Martinez, public commenter: Yes, my name is Sophia Martinez and I'm president of the Concerned Citizens of Wagon Mound and Mora County in New Mexico. And I do want to thank the members of the White House Environmental Justice Advisory Council and thanks to the Administration for creating that and centering to some degree environmental justice. I appreciate that and I'm glad to see people whose work I know on the council that inspires a little bit of trust and knowing oftentimes that our communities often negotiated away and issues of finances federally and other issues. So, again, I have trust and faith that you all are advocating for our communities. I come from a small community in northern New Mexico, which, if you count the little babies and elders, possibly 400 people. But just to give a kind of an idea, again, of what we've heard from other folks, in terms of speaking for environmental communities, or environmental injustice communities, I would say in the last four years in our community of maybe 400, including everyone, babies and everybody, right, we have had three suicides in the village. Two suicides. Of course, the grandpa, or the father and grandpa who lives in the village—[audible interruption].

Okay, so again, just kind of looking at that in a small rural community where you can have up to five suicides within a four-year period, we had a couple of COVID deaths, we had a couple of old age death's—we have a couple of centenarians in the village—but most of our deaths in the last three, four years have been from drug cirrhosis of the liver. And again, as they said, five suicides for a community of 400, right? But then again, that's the rural community, maybe similar things are happening in urban areas due to police violence, and all these kinds of things that highlight poverty, structural violence in our country, right, whether it be race, class, gender, sexual orientation, etc. So those are things that are cumulative impacts in our communities. And we have to kind of, you know, find a way, oftentimes in a society that keeps talking about science. Science is not necessarily what the institution or the colonial

government basically, identify, right. So that's one recommendation that would be that we would give is that technical issues are a part of permitting, but at the same time, are Indigenous and grassroots and land-based knowledge is extremely important and could really benefit people fighting fires, fighting floods, these kinds of issues.

You know, lately in the northern Mexico, we have suffered the fires, which everybody heard about some of the largest fires in the state, started by the federal government. We want to know what the responsibility and accountability is going to be to our people. Our people that don't have foundations in their houses, our people who don't have clear title to their land because it's been passed through generations of hundreds of years. And then the suffering, more despair is created, affecting especially younger people. And so, what happens when despair is created, the predators come in, right? So everybody in Mora County whose lives have been impacted by fire and now flood, as well as our brothers and sisters in Kentucky and California, we recognize the suffering that they are going through, but then the predators coming in. Especially in New Mexico, it's a big issue because this state is unique in terms of that we are minority majority state, the minority people who are poor basically own land, which is not a thing that we can say about people of color throughout the United States. And so predators are coming in now, "Want to sell your land?" because New Mexico is beautiful, like my sister from the East, like we have a state of Encanto, but that's a false narrative. Because the reality is we're the new colony for the United States, whether it be from nuclear—recently, you heard from the Tularosa Downwinders Consortium, victims because many of them have died generational cancers, the grandparents, the fathers, and now the people working actively and living actively today in remission are suffering with breast cancers, the result of the secret Manhattan Project, and just as we're erasable people, so too were the people from the Tularosa Basin where the most powerful weapon known to humanity was developed, tested here in New Mexico, and then now has become the dumping ground for nuclear waste, right? Because people were forgotten. RECA, the Radiation Compensation Act that was passed to compensate folks that were the victims and survivors of this nuclear cycle in this country, they were totally forgotten. Arizona and Nevada and Utah were compensated, and I received healthcare support; the Downwinders, two people in New Mexico have not received that in terms of being the first victims of this testing. We are happy that through our representatives and senators and again, the administration, we were able to extend the sunset of RECA and hope that you all focus in and help basically expanded to include New Mexico, Colorado, Guam, and those other places that have been impacted by the nuclear dirty—the dirty energy that is nuclear. And I'm not even going to go into the Waste Isolation Pilot Project that dumped for the United States in terms of nuclear energy, and the expansion that is trying to go through now. The plutonium pits that are being promoted in Los Alamos when it is clear that there are not even enough specialized staff to deal with generating the amount of plutonium pits are basically nuclear weapon triggers, is what that means. Nor are the facilities adequate for the kind of development that needs to happen, not to mention the fact that of course, the community doesn't want it.

I would want to get one more public comment, if I can, to just say that interagency communication is probably one of the biggest impediments to communities being heard. And so we would hope that there would be that scorecard that people have mentioned in some form of accountability rather than a checkbox, when we talk about these kinds of environmental racism and environmental injustice issues. Thank you.

Dave Arndt, public commenter: My name is Dave Arndt. I'm a Baltimore Maryland resident and a climate and environmental and social justice advocate. I really thank you for your work that you're doing and this opportunity to give my testimony. And I really appreciate the questions and comments that you pose to the DOE representatives and to the presentation. I want to take a look at the Brooklyn and Cherry Hill communities in Baltimore, which are listed on the DOE's disadvantaged community site that was just presented. In this community they have two incinerators within five miles. One burns trash, the other is the largest medical waste incinerator in the U.S. And now if we look a little bit more

at these communities, you'll see three RMP facilities, a chemical factory. Plus, there's a working port, which drives a lot of heavy-duty truck traffic through the neighborhoods, plus a very large distribution center for packaging, plus several major interstates. In December, there was a coal explosion in Curtis Bay. And for this Curtis Bay area, they've been complaining about the coal pile for decades. OSHA has just fined CSX for the negligence. However, this does nothing for the coke gas that floats around through this neighborhood daily. In March, there was a three-alarm fire at a fuel facility killing one person, with fumes drifting over the neighborhood. And there was no communications with the residents of what they should do. For instance, do should they stay at home? Should they leave the area? Is everything safe? There is no notification at all. These neighborhoods are also in the low-lying areas, which are known for nuisance floods. And just recently, I saw that there's three once in 100-year rain events in the U.S. If one of these hits Baltimore, this area's going to be in deep trouble because there's no disaster plan in place, and no resiliency planning in place for these factories that are in these neighborhoods. These neighborhoods really are sacrifice zones. And for decades, companies have profited while the health and wellbeing of the residents were of no concern. The federal government needs to really step up and allocate funds to help drive pilot programs to implement in a community driven plan to reimagine these neighborhoods so they can be models for other communities and climate justice. We always have to remember that these people do not have time, because being poor is really a full-time job. And they're just struggling to keep food on the table and have a roof overhead. So we need help and we need the EPA and other government agencies to be there now and to be working now and not just listen but create plans and implement now and start the process now. Thank you very much.

Rami Dinnawi, public commenter: Thank you very much. My name is Rami Dinnawi. I'm currently leading the environmental justice work of El Puente, here in the south side of Williamsburg. El Puente was founded over 40 years ago and one of our co-founders who passed away over two and a half years now passed away from lung complications. And that is due to the poor air quality that we are facing amongst many other environmental justice groups and communities due to racist infrastructure that was implemented by design by local, state, and federal governments throughout the United States history. So, we come here at a great opportunity where we have the chance to be able to participate in shaping how we want to receive or design our own form of reparation and government responsibility towards the communities that it has impacted over the years. And at El Puente, we have worked tirelessly to view environmental justice from an intersectional lens, not just through the environment, but to us environmental justice means social justice means immigrant rights means green infrastructure. So when thinking about useful indicators for a scorecard, what comes to mind to us is race, ethnicity, immigration status, the legacy pollution sites, access to voting sites per residents; we also look at the Air Quality Index within certain communities and neighborhoods, and the proximity to high polluting infrastructures. And as well—like listening to the panel that was before by the DOE—we also appreciate when we look at the number of—if this body would look at the number of service and oversight visits by these government agencies that use these as metrics to hold these private partners accountable to the metrics that they decide to enforce when implementing Justice40. In closing, I would say thank you for the work that you're doing and for the pushback that you're presenting, and looking forward to working with all of you and to have our voices finally heard within the high levels of decision making.

Stephen Buckley, public commenter: Thank you. The presentation that was made by the Department of Energy people reminded me of when I used to work at the Department of Energy there in Washington, DC. My office was about 100 feet from the secretary's office, and I worked in the environmental cleanup program, which is the Environmental Management Program, EM. My job was to make sure that in all the cleanup of all the various legacy sites around the country, which of which there were hundreds, that the public was involved in a meaningful way and complied with the Council of Environmental Quality's regulations, requiring under NEPA that the public was involved, complied with the public involvement regulations of CEQ. Unfortunately, CEQ does not—has regulations that all agencies are supposed to follow, but it has no enforcement mechanism; it doesn't go out, it doesn't

check to see if anybody's following; they just ask the agencies how you've been doing—"Have you been doing public engagement?" And they go, "Yeah, we had a meeting, and everybody had three minutes at the microphone. So we're done." And unfortunately, that does not make for a very good feeling. So, when I saw that, I was afraid that the same thing would happen all over again. I did report that the project teams were trying to circumvent the public engagement aspect, and for that I was fired—as a federal employee, not a contractor, which does take quite a bit to do. But that's because I did not keep the—it was my job to point out when DOE employees were circumventing the law. And so, things may have changed. And I would like to know, I guess, if, in this new approach, under the fossil energy, the coal containment thing whether they would be able to do something differently. But it's on them to show that there will be genuine—if they're going to be evaluated by DOE on how they conduct community engagement, there needs to be a way that's transparent so we can see what that criteria is, and not just whether or not they held a simple meeting. Thank you very much.

Stephanie Herron, public commenter: Thank you for the opportunity to comment today. And thanks so much to all the members of the WHEJAC for your service on this council and to EJ communities over many years. On the EJ scorecard in particular—and apologies for my thoughts not being as fleshed out as I would like them to be—I wasn't sure if I would get up today. But some of my thoughts are that the number one most important underlying thing that I cannot emphasize enough is that the EJ scorecard must work in conjunction with the climate and economic justice screening tool. The two tools absolutely must, must, must be designed in a way that they can work together and reinforce one another and hold each other to account. I would agree with several of the metrics that two commenters in front of me raised such as race, socioeconomic status, air quality index. I thought those were really excellent recommendations. Some overarching things that I think are critical about the EJ scorecard are that benefits—while they are not one size fit all fits all and that a thing that is a benefit to one community might not be right for another—the EJ scorecard must use clear and consistent definitions across agencies. A big concern that I have right now, especially in this time of the screening tool not being finalized, is that as we heard from DOE, they're using their own metrics to define what is a disadvantaged community and what is an investment benefit. And if every agency is using a different definition, going in on the front end, it is impossible on the back end to assess or score them in a way that is accessible or even makes any sense that meaningfully tracks progress across the federal government. The EJ scorecard must track the dollars and the investment benefits by the race and income in communities. Without this information, it's impossible to ground truth the EJ scorecard or the screening tool, and it's impossible to show whether Justice40 and other EJ initiatives are working to address environmental racism or actually benefiting EJ communities because we won't have the information we need to do that. The EJ scorecard should track where federal investment benefits flow to the most granular geographic level possible; by county or by zip code is not adequately specific to show patterns in public health, or environmental challenges, or socioeconomic challenges, positive or negative. Particularly in very urban dense communities or very rural communities that'll be even more important to be as granular as possible geographically. And I'm going to wrap up due to the interest of time, but there must be an opportunity for communities to meaningfully engage in the development of the EJ scorecard, which this is one great example. But there needs to be direct engagement with community residents in EJ communities. And also—and especially to ground truth the EJ scorecard and the information that comes out on it, and to say whether they agree that their communities were benefited or not. And that is another reason why the granularity is particularly important because if you say by a county, that doesn't really mean much to me if I live in a very specific neighborhood within the county. Thank you.

Chrystal Beasley, public commenter: Thank you for the opportunity to be here on this evening. I certainly want to take the opportunity to thank you guys for organizing and putting this together. But certainly, it is necessary for numerous reasons of us being here today. It is of huge concern about the accountability of industry. I am located within the Houston, Texas, region, which falls within the Houston-Galveston-Brazoria County region, where our air quality has yet to meet the EPA attainment

levels. And we are sure, as you know, in the process of potentially moving to a severe threat within our region. Unfortunately, Texas Commission on Environmental Quality continues to use their ordinances to allow industry to find ways to increase their emissions outside of their normal Title V permitting requirements and outside of the NSR permitting required were requirements that have been developed on the federal level. And they do that using strategic tactics such as permit by rules, right. So that's simply where industry can make modifications to their operations and add different equipment which have supplemental emissions, and then all of this stuff gets tied into future renewal of permits. And what's very unfortunate is that the enforcement aspect of people staying within their permit requirements is not being provided in our local regions. We certainly need Texas Commission on Environmental Quality to be audited. They need contractors support to help with enforcement efforts. We see numerous occasions where industry permits are up for renewal and these companies have continuous violations under the Clean Air Act or continuous violations under the resource conservation Recovery Act. And TCQ will move forward with accepting their permit renewal application and giving these industries a new permit.

We need more enforcement within this country, specifically within my region. We also need the support of the EPA and any other constituents to hold industry accountable. Hold them accountable. It should not be ethically nor regulatory viable for these companies to come paying you to violate—and this is information that's available through the EPA enforcement website—where we can see continuous violations and they continue to operate without any penalty, and the slap on the wrist with the violation of funds that they slap on them—I mean, it's not anything that's helping the communities. Our children are dying left and right in this area of numerous forms of cancers, specifically lung cancer, we have adults that are that are dying. I mean, clearly, we have a medical center here that focuses on cancer and that's because the air quality here is not even meeting the current national ambient air quality standards that have been developed on the federal level. We need some accountability. And at this point, it's extremely sickening. If the U.S. government is going to continue to allow industry to pollute the air and continue to operate, then communities need to be compensated with those funds directly, not compensated and—“We will build you a park” or “We will build you a garden.” No, people need to be compensated financially so they can make definitive decisions on whether they want to uproot their families, or if they want to remain there and continue to increase their public health risk. But staying in locations where people have been redlined in history where they were not allowed to buy properties, or own homes and other reasons. The government has allowed industry to come and build in these in these areas and know that it's not within a safe public health risk is just detrimental. So if we want to address environmental justice, we need to look at history and look at how those impacts are now impacting people of color and the money that these industries are making and being fined for, that needs to go directly to the individuals who are breathing in the terrible air that they are emitting from their operations.

Lydia Ponce, public commenter: Thank you. Lydia Ponce calling from the unceded territories of the Tonga people of the Tonga Nation, infamously known as Venice, California. And what can I say to make my words matter and uplift all the speakers before me? My heart is just sincerely breaking. It's my first granddaughter's sixth birthday and what are we going to be living in 10 years from now? I live in a place that was hyper-gentrified in the last 25–30 years, where only black and brown families could live in build community, where now the park have families that sacrifice their homes to build a park because of Jim Crow laws. White dog owners are now letting their dogs off leash. Why is that all relevant? Because there are people with green lawns, when you drive through town, when you drive through our municipalities or our neighborhoods, and you know that they're overspending and overusing water use, but fines are just not a significant financial burden for them. So how is that relevant to the whole national state, the whole national state with everything that we're talking about here as far as industry, so we're about to suffer sea level rise in Venice, in our coastal California and different places and spaces. So I ask you, if everyone on this call, and there some in the last year and a half have come to you and told you the woes and the perils of health and challenge economically and sincerely from thriving,

thriving families, thriving children and grandparents and elders who have afforded the rest and the comfort of their family and their grandchildren and great grandchildren.

That scoreboard, that scorecard—whatever it is—needs to be accompanied with a national community oversight—a national community oversight—because the consultation and consent for frontline communities and Indigenous peoples it seems and it appears that it doesn't matter because the corporations will get what they want when they want a permit. For example, desalination. Everybody is upgrading desalination. Everybody wants to do some desalination, but those of us who know the truth, they don't know what to do with the brine. There are daily deposits of thousands of—hundreds of thousands of gallons of brine and toxic chemicals swirl into the ocean. It's going to be dotting our entire coast of California and in the Gulf of Texas, without any kind of real solutions as to the pollution mitigated. It's all about economics. It's about jobs that people are going to be too sick to work at. We hold the extractive industries accountable. They just continue to cause harm and profit and turning a blind eye and a deaf ear to the people suffering, including their employees. So, what part of J40 is the healing for water, for land, for air, and for people, as I witnessed so much discomfort and inconvenience for frontline communities and people of color, I witness the death, the ecocide, the femicides, genocide, and eugenics. It's a different form of eugenics you have children born, not well, challenge with breath, challenge with the mental health, challenge even with thriving themselves at birth. So, the last part of my piece here is that our shared future is just looking at the gross national product of fear, our gross national product of NIMBYism, and the greenwashing that's happening, especially with Manchin's climate bill, which I call his plan to keep the oil and gas industry happy. We have sacrifice zones that are being maintained further by some of these plant that were presented today, and how much we're going to invest in the sacrifice zones. Last I checked no one—not one human being—is illegal, and not one human should be sacrificed. And that we need to reduce, and we need to become energy efficient, and we need to stay connected, and I thank you for your time and your efforts.

Melodie Aduja, public commenter: Aloha WHEJAC Council. My name is Melodie Aduja, co-chair of the environmental caucus of the Democratic Party of Hawaii. I reside on Oahu where the Red Hill underground fuel tanks are located. These tanks hold over 100 million gallons of jet fuel a mere 100 feet above Oahu's sole source aquifer. On June 30, the Navy provided a defueling plan, which was rejected by the state's health department because it lacked sufficient detail. The plan calls for extensive repairs to the pipelines, which appear unnecessary as the facility is to be decommissioned. Currently, the Red Hill system allows the fuel to flow down from the tanks by gravity feed to the piers at Pearl Harbor through three 2.5 miles of pipelines. Repair completion date is set at December 31, 2024, when defueling can begin. Once defueling begins, then it could take another year or more to completely drain the tanks. Under the navy's plan, defueling can take as much as four years or more. Meanwhile, 100 million gallons of fuel remain in the tanks waiting to cause another catastrophic spill. Another spill could enter the municipal water system, contaminating drinking water for over 400,000 residents from Honolulu to Hawaii Kai, including high density Honolulu and Waikiki. Rather than piping the fuel down 2.5 miles from the tanks to Pearl Harbor, it would be easier to repair the tanks as opposed to the pipelines and to move the fuel out through a new pipeline close to the tanks and into tanker trucks. The fuel can then be transported via tanker trucks into above-ground tanks at Pearl Harbor or to the hotel pier and to fuel tanker ships for shipping or storage. Here, defueling would take months rather than years. As each tank is drained, the risk of another catastrophic release would be minimized as required by Oahu to build trust in the military. Right now, there is absolutely no trust in the military. It has delayed this process in each and every step. Just yesterday, the Hawaii news revealed that the Navy's water systems still tested positive for jet fuel after the military and the state health department declared it was safe to drink. Though assumption is that the detection of JP-5 or residual contaminants from the fuel released into the navy's drinking water on November 20, 2021. Military families have suffered and continue to suffer nausea, vomiting, diarrhea, dizziness, headaches, itchiness, and rashes from contaminated water. The same aquifer that supplies the Navy's water system supplies the municipal water system. There is no alternative than to shut down Red Hill as expeditiously as possible.

Three to four years is too long. One year or less should be sufficient time to defuel. Mahalo nui loa for this time to provide comments. Thank you.

John Mueller, public commenter: Well, once again, thank you, WHEJAC members and interested federal officials for these opportunities to provide valuable public input. I am John Mueller, and I have provided comments at a number of WHEJAC and NEJAC public meetings as a private citizen and activist. My most relevant professional experience supporting my comments about water fluoridation is as a licensed professional engineer and former water treatment professional in the public sector, initially with the Santa Clara Valley Water District in San Jose, California. And then with the City of Tulsa, and its environmental operations and later water and sewer department as a senior engineer. I am now retired and have been for several years. I would like to first acknowledge that at the last NEJAC public meeting on June 22. The chair of the NEJAC, Sylvia Orduño, immediately following my three-minute comment, was very explicit about certain aspects of my participation in the many NEJAC public meetings to the extent that she suggested that I could be very helpful in serving the NEJAC in somewhat of a consulting capacity for resolving the fluoridation issue as an environmental injustice. I would very much look forward to that opportunity but have not yet actively pursued it from my end. I hope to engage with Chair Orduño in the near future and would certainly welcome that opportunity with WHEJAC as well. I recognize that the purpose of public commenting at today's WHEJAC meeting is specifically for—and I quote—"the development of an annual public performance scorecard and the types of indicators or data that would be useful in a scorecard." This applies to fluoride exposure. Emerging science has shown common fluoride exposure to be more harmful to public health—comparable to lead—than it is beneficial. Ending the promotion of community water fluoridation—CWF—by the CDC would entail a paradigm shift to promoting more effective alternatives for treating childhood tooth decay, such as Scotland's highly successful Child Smile program. Such programs here could be modeled on programs based on criteria described in what Holly Buck from the Office of Impact and Diversity, which she presented earlier in today's meeting. Accordingly, a scorecard for assessing progress in addressing the environmental injustice of fluoridation must necessarily include CDC's database of water utilities participating in its CWF program and their success with more efficient and effective targeted oral health programs. EPA Administrator Regan will have an opportunity to address this issue most expeditiously by granting approval of an anticipated petition to be filed with EPA under provisions of the Toxic Substances Control Act, expected sometime in the next few months. Tooth decay is repairable that brain damage, we might say, is a horse of a different color. Thank you again for these important opportunities.

Brenda Staudenmaier, public commenter: Thank you. My name is Brenda Staudenmaier. I am a plaintiff in a federal lawsuit against the U.S. EPA over the neurotoxicity of fluoride chemicals that are added to the public drinking water supply. I also work in the Wisconsin water industry. I believe I've spoken at these meetings in the past once and wrote a letter. My heart goes out to everybody who has spoken before me today. You know, we have some big problems in this country. I just wanted to make a comment on the scorecard regarding water fluoridation and how it's neurotoxic to the brain. Dr. Grandjean from Harvard Public School Health did a benchmark dose analysis recently. It was published in 2021 and he found 0.2 milligrams per liter would harm some children if they're exposed to that concentration. And I know a lot of naturally occurring water in the United States is at much higher levels. Some water is at 1.5. The EPA has MCL, maximum contaminant level, of four milligrams per liter, which in 2006, the National Research Council advised them to reduce that level because it wasn't protective of human health. And they have failed to do that. So I would like to see the scorecard include water fluoridation levels, and which levels are high or above, you know, 0.2 even I would say. That's pretty much all I want to say about the scorecard. You guys are well aware of the neurotoxicity issue by now. And thank you, John Mueller, for speaking before me.

Richard Moore said that public comments mean a lot to the WHEJAC, and the Council takes recommendations very seriously. He said that the WHEJAC has heard and continues to hear testimony

from communities about legacy issues, military toxics, and other longstanding issues, and that WHEJAC and members of the public are looking for a response from CEQ or higher up in the White House or other federal agencies. He thanked everyone for the tremendous amount of work they have been doing for many years.

Victoria Robinson reminded listeners that they can submit written comments through Thursday, August 18, via a form on the website.

George Ward added to the chatbox: Written public comments can be sent to whejac@epa.gov or sent through the webform: <https://www.epa.gov/environmentaljustice/forms/white-house-environmentaljustice-advisory-council-whejac-public-comment>

Victoria Robinson added that written comments also can be sent to www.regulations.gov for Docket ID No. EPA-HQ-AO-2022-0050

Peggy Shepard remarked that it had been an interesting day. She said she's happy to have heard from Dr. White-Newsome on how to will move forward on public recommendations that the members have been hearing for years. She added that she's looking forward to hearing from CEQ Chair Brenda Mallory and to the discussion on Justice40 and the screening tool, as well as a discussion about the pollution from incinerators, which came directly from the public comments voiced at the last meeting in June.

Catherine Coleman Flowers thanked those who joined the meeting and to those who made public comments. She said all of them are committed to ensuring justice in communities throughout the United States where people don't have to deal with environmental justice issues.

WHEJAC Vice Co-chair Carletta Tilousi said that the public testimony makes clear that the country is in crisis and that water is a key concern. She said we are not moving fast enough to help families and communities in crisis. She said she will continue to echo the voices she hears and the WHEJAC will do its best to pressure agencies and the administration to move things forward faster. She said activists, community leaders, and political leaders all have a responsibility. She thanked tribal members and Indigenous people and commenters from Puerto Rico for their testimony and said she is looking forward to tomorrow.

Amanda Aguirre, Senior Advisor to the Chair, CEQ, echoed everyone's gratitude and appreciation for people who made comments. She said CEQ looks forward to reflecting on and responding to the information shared at the day's meeting.

Adjourn for the Day

Victoria Robinson closed the meeting.

Thursday, August 4, 2022

Introductions

Victoria Robinson opened the meeting and reminded attendees of the listen-only format for the day's meeting.

Peggy Shepard welcomed attendees. She summarized the WHEJAC's origins and purpose and listed the workgroups. She shared an overview of the day's agenda and thanked individuals who gave public comment yesterday.

Richard Moore welcomed participants and attendees. He thanked those providing closed captioning and interpretation services. He thanked those who made public comments at yesterday's meeting and said that the public comment period is crucial. He said they continue to hear about legacy pollution and military toxics, and he asked attendees from federal agencies to listen and to act on what the public shares with them.

Catherine Coleman Flowers said she is looking forward to the meeting and to moving forward with trying to increase justice for communities have suffered for so long.

Roll Call

WHEJAC members present

LaTricea Adams
Susana Almanza
Robert Bullard
Maria Belen Power
Catherine Coleman Flowers
Tom Cormons
Angelo Logan
Maria López-Núñez
Harold Mitchell
Richard Moore
Rachel Morello-Frosch
Michele Roberts
Ruth Santiago
Nicky Sheats
Peggy Shepard
Carletta Tilousi
Viola Waghiyi
Kyle Whyte
Beverly Wright
Miya Yoshitani

WHEJAC members not present

Jade Begay
Jerome Foster II
Kim Havey
Juan Parras
Hli Xyooj

Victoria Robinson confirmed there is quorum and reminded WHEJAC members that they need to maintain quorum to continue the meeting.

Peggy Shepard introduced Council on Environmental Quality Chair Brenda Mallory.

CEQ REMARKS

Brenda Mallory, Chair, Council on Environmental Quality:

Hello, everyone; it's good to be here. And as always, I appreciate the invitation to come and say a few words to kick off your meeting. I know yesterday was a successful and productive meeting, so I'm sure

that that will be the case today as well. I particularly want to welcome the those who are tuning in from the public who may not have joined the White House Environmental Justice Advisory Council previously and welcome them to this session. As always, I want to express my immense gratitude to the WHEJAC members themselves for all the work that folks have been putting into this effort for the last year and a half. That work has been very important and crucial in helping to develop recommendations that are guiding our decision making and policymaking as we move forward and trying to advance environmental justice across the federal government. And I know that the recommendations that you will approve today will also be very informative for the work that we are doing. So, thank you all for that effort.

I am so pleased that the WHEJAC and folks in the public across the country had a chance to meet yesterday our incredible new Senior Director for Environmental Justice Dr. Jalonne White-Newsome. Jalonne brings so much deep understanding and policy expertise to CEQ, as well as a longstanding commitment to communities and a real desire to help advance the President's bold and historic commitment to a whole-of-government approach. So, it's been great having her for the short time that she's been here. And we can already feel her influence, both in CEQ but also across the agency. So, I'm very grateful for the work that we will do together as partners, and proud of the overall CEQ team. I know Richard mentioned earlier just the incredible work that this EJ team does and that that has been true from day one, just countless hours and weekends and late nights. And you all know that because you're often working with them. And so, we're just grateful for that that partnership that has occurred. But I think we all recognize that the tasks that we have of trying to reorient the federal government to really make a difference for communities is one that requires this commitment. And so I'm grateful to have a team—a small but mighty team—at CEQ who is willing to put in that effort. Smart, talented, driven folks who I am just so privileged to call my colleagues so I'm grateful for the team.

Let's see, before I jump into some of our updates, I would be remiss if I didn't acknowledge the activity that is happening on Capitol Hill right now as we await progress on the Inflation Rate Reduction Act. As all of you I'm sure have heard this is a significant—potential significant act that really would be historic for climate action and environmental justice in terms of the programs that we are trying to pursue. So I'm hoping that bill continues to go through and a successful progress. You will hear more about that later, I'm sure.

So, switching to our work at CEQ now, similar to past meetings, what I'd like to do is just provide a few updates, beginning first with the environmental justice scorecard, I believe Jalonne discussed this yesterday, somewhat. Yesterday, CEQ issued a formal request for information on the first version of the environmental justice scorecard, which is now available in the Federal Register. This Federal Register notice was informed by recommendations that we received from the WHEJAC in March of this year. And we developed the RFI in a way to seek the public input on the vision and the framework and the outcomes that we have heard collectively from the WHEJAC and others and our own conversations about what makes sense as we launched the first, in some ways foundational scorecard to set us up. The first version will definitely be a starting point and one that we will build on as we go from year to year as we get more information and more data to build into the effort and the ability to assess the what the agencies are doing, what their activities are, and how we can capture that information in something that serves as an accountability mechanism. So, it will provide a baseline assessment of agencies' activities, including their work to reduce burdens, deliver benefits, and undertake institutional reforms that ensure that the voices of communities are reflected in the decision making. In order for the scorecard to be an effective tool for accountability, it will need to get more detailed as we move forward. And so that's our expectation as we move forward with this initial scorecard, that we'll hopefully have out in the next couple of months now that we have this comment process underway. I'm also hopeful that folks will take the opportunity to provide some feedback. There is a 60-day comment period that has been launched with the RFI now, and so please share it in your networks so that we can hear from a broad range of folks about what makes the most sense as we try to build off this tool.

Also turning to the Justice40 Initiative, since we last met, the federal agencies have begun to release publicly the listings of Justice40 programs that we've identified. And at this point, I'm proud to say that we have hundreds of programs that have been identified across the government as being included in the Justice40 initiative. What we're hoping to do through this process—and here again, I think we heard from many of you about what works best—is to have the—as we put out the information about the initiative and what programs are covered, it allows for some public review and engagement, some ability to see what we think are the programs that make the most sense and to allow for giving us some feedback on that. And what we heard in terms of this being an important transparency step was that these lists work better and people can process them better if they come out in groups. And so that's what we've been doing. Instead of releasing a lot of information at once, to allow the programs to be identified and to create an opportunity for folks to review that and provide feedback on that. After hearing from you all, the approach seems like it makes the most sense. So if people are finding it difficult to kind of maneuver, the way we're proceeding on this rolling basis, I'm sure that folks can share that.

All of the Justice40 programs, as this group knows, are required to engage in a stakeholder consultation process to ensure that the community stakeholders are meaningfully involved in understanding and determining what it makes sense for us to be focused on in terms of benefits. And so this list really is very crucial, knowing what this list is, is very crucial for that process and that shared understanding of what the federal government is doing. The list of Justice40 programs will be updated periodically, and it's included on our website, the [whitehouse.gov EJ website](https://www.whitehouse.gov/ej). So that's always a place to go to identify information or to locate information that that you may have missed when it went through. But you can use that as a resource for tracking what we've made public.

The President's push to confront environmental injustice through the Justice40 initiative is sparking changes both big and small across the federal government. And we're at various stages of progress, I would say in different agencies and organizations. And some of those changes are obviously more cultural shifts and institutional reform that we are aiming for. So, in those cases, I think that it's going to be a more challenging effort to realize some of those, but with the support of our partners and congressional allies, and additional budgetary support, I think that'll be important, as we think about some of the bigger changes that we are hoping to see made through this process. But we are—I would say, across the government, not only in CEQ, but in all of the agencies—focused on this work and the ways to make the Justice40 initiative work in the way that the President envisioned when this idea was discussed.

So, there's a lot of really important work that's happening at CEQ and across the federal government at this point. We can't do this work alone. I say that all the time, and I'm just grateful for the help that you all are providing for your ideas that people are putting forth for the recommendations that we get from the collective and for the overall partnership. So, I just want to underscore again, how much I personally and the CEQ team writ large really appreciates the work that you all have been doing with us. So, with that, I will turn it back to Peggy. Thank you so much.

Justice40 Workgroup Proposed Recommendations: Overview and Deliberations

Peggy Shepard began by explaining that the premise for the Justice40 workgroup recommendations is that implementation must be as transformative in practice as it is in theory. She shared crosscutting recommendations categorized as Transformative Practices, Public Engagement, Grants and Funding, Proposed Infrastructure Projects, and Accountability and Incentive Structures.

Transformative Practices

Peggy Shepard said that the group submitted recommendations in May 2021 that explicitly asked the federal government to end—not extend—support for fossil fuel infrastructure. Instead, she said, the Administration has asked CEOs of fossil fuel companies to increase production and has opened public land to increased investments in technologies that extend the dominance of fossil fuels. Contrary to the intention of Executive Order 14008, this will increase climate pollution. Peggy Shepard reiterated the group’s strong opposition to increased fossil fuel infrastructure. Further, Peggy Shepard said that last year’s recommendations also expressly stated that Justice40 investments should not increase harm to communities; non-biological carbon capture, use, and storage should not be considered benefits to communities. She said if the Administration acts against these recommendations, it perpetuates the marginalization of disadvantaged communities. Therefore, the workgroup made seven recommendations regarding such practices with the goal of transforming the practices of federal agencies to ensure that J40 investments rectify—rather than reinforce or amplify—existing inequalities. (Specific recommendations in each category can be found in the appendix D, slides 72–82; the full recommendations can be found online at <https://www.epa.gov/system/files/documents/2022-08/WHEJAC%20J40%20Implementation%20Recommendations%20Final%20Aug2022b.pdf/>.)

Public Engagement

Peggy Shepard said the goal of public engagement recommendations are to ensure that public engagement is integral to each agency’s Justice40 implementation process, not an add-on or an afterthought. Communities and stakeholders should provide on-the-ground knowledge that improves the design, implementation, and evaluation of Justice40 programs and investments. The workgroup made 10 recommendations related to public engagement, such as ensuring that agencies have a responsive and flexible public engagement plan, and funding state agencies to add a J40 Community Program Manager position responsible for direct outreach to target communities.

Grants and Funding

Dr. Beverly Wright said that the 11 recommendations of the grants and funding category serve to close the opportunity gap between well-resources communities and disadvantaged communities and increase their capacity to apply for and administer grants. Specific goals include establishing regional federal grant assistance hubs in the most disadvantaged communities to provide direct assistance with applying for grants and other opportunities and supporting small communities and community-based organizations after a successful grant application.

Proposed Infrastructure Projects

Dr. Beverly Wright The goal of the four recommendations pertaining to proposed infrastructure projects is to reverse the legacy of infrastructure projects disrupting community life in frontline communities and ensure that these communities get the investments in infrastructure that sustains and improves community life. Specifically, this includes ensuring that federal government-funded infrastructure projects increase social resilience by supporting social infrastructure, such as schools and childcare, and providing the public with plain-language information on renewable energy infrastructure projects to ensure that the transition from fossil fuels does not continue to overburden disadvantaged communities.

Accountability and Incentive Structures

Dr. Beverly Wright said that the goal of recommendations in this category was to ensure that robust and effective incentive structures are put in place to create accountability and the successful implementation of Justice40. Among the eight recommendations in this category are incorporating relevant J40 implementation metrics into individual performance evaluations at all agency levels and releasing J40 funds through staggered disbursements that are contingent upon completion of work

stages or milestones to ensure that money granted to states and localities is implemented in accordance with both the spirit and the letter of J40.

Peggy Shepard invited a brief discussion.

Ruth Santiago called to attention an agency-specific recommendation for CEQ regarding its interim guidance. She said the guidance uses the term “clean energy” rather than “distributed renewable” energy. She said she hopes the final guidance will use “distributed renewable energy.”

Tom Cormons gave some background, explaining that the workgroup drafted its recommendations to facilitate an expectation from the White House that agencies will intentionally reach out to and include communities in the planning and rollout of Justice40 initiatives.

Richard Moore thanked the workgroup for their time and work drafting the recommendations. He voiced support for Ruth Santiago’s comment. He added that you cannot replace an injustice with another injustice in the name of justice. He said federal agencies must become much more creative with state agencies in terms of accountability requirements. He added that he strongly supports the recommendations.

Carletta Tilousi asked how J40 funds will be available to tribes. She added that there are native/Indigenous nongovernmental organizations, and she would like to see some of the J40 funds flow to native and indigenous communities. She added that tribes and sovereign nations have processes and protocols developed for seeking federal grant dollars.

Peggy Shepard asked someone from CEQ to respond to Carletta Tilousi’s question about how funds will flow to her communities. Jalonne White Newsome said she would get back to her with a reply.

Susana Almanza thanked the J40 working group and said if all the recommendations were adhered to, it would be a true paradigm shift. She added that she wanted to make sure that low-income housing is included among infrastructure recommendations because the cost of housing is a crisis, forcing people to double up and triple up whether they rent or own. She said she supports the recommendations.

Viola Waghiyi added to Carletta Tilousi’s comment about funds available from EPA. She said that tribes, as sovereign nations, work with EPA; there has never been oversight of the two formerly used defense sites on her island. She said it’s going to take an act of congress to begin an investigation. She added that she supports the recommendations and accountability is needed to address environmental violence and environmental racism. She said Justice40 needs to address food security among arctic Indigenous peoples.

Ruth Santiago said, regarding the issue of food security, she wanted to highlight a recommendation to the Department of Agriculture to provide energy assistance in the way of distributed renewables to small farmers, especially in Puerto Rico, which imports at least 85% of its food. She said that utility-scale renewable energy projects should not be sited on agriculture land.

Michele Roberts asked CEQ to describe its strategic plan for making transformative change that leads to justice.

Peggy Shepard noted that the time for discussion has run out. She said of the two potential new recommendations, Ruth’s recommendation around clean energy is recommendation #43 in the draft, and the low-income housing recommendation suggested is #82. She asked for a consensus vote on submitting the recommendations to CEQ and IAC.

Dr. Beverly Wright made a motion for a show of hands. **Susana Almaza** seconded. There were 20 votes in favor, zero against, and five members were absent; therefore, the recommendations will be submitted changes to CEQ.

Break

Richard Moore asked when CEQ would share the recommendations with the federal agencies. **Dr. Jalonne White-Newsome** said she will look into how the recommendations from previous WHEJAC meetings were processed. She said that, legally, they have a year to process the recommendations, but she would like to work with her team to process them in a thoughtful manner with the IAC. She said she does not want to commit to a time frame now; however, she said it will not be a year. She said she will get back to the WHEJAC with more details as the process is clarified.

Richard Moore added that the WHEJAC has been concerned with timing and that Federal agencies are already in the process of holding discussions and making decisions. He said the WHEJAC expects a report back on how the process is moving forward.

CEJST Proposed Recommendations: Overview and Deliberations

Catherine Coleman Flowers, Chair of the CEJST Workgroup, said that workgroup members Rachel Morello-Frosch and Nicky Sheats will present the recommendations.

Dr. Rachel Morello-Frosch reminded participants that the workgroup had developed recommendations quickly and then waited for quite some time for the release of the beta version of the screening tool, which was released for public comment in February [2022]. Public comments closed at the end of May, and the workgroup was asked to provide additional recommendations on how the tool can be improved going forward. She said version 1 of the screening tool is expected to be released at the end of the summer, but it will continue to be updated. So, the recommendations are presented with that in mind.

Dr. Rachel Morello-Frosch added that the recommendations also point CEQ to data sources for the recommendations. (For the slides presented in this discussion, see appendix D, slides 85–87)

Dr. Rachel Morello-Frosch and **Dr. Nicky Sheats** presented the following recommendations:

1. **Integrate indicators of structural racism**, such as redlining and racialized disparities of wealth.
2. **Include relevant indicators of Native American and tribal lands**, developed in consultation with Indigenous peoples and tribes and recognizing that displaying more data is not necessarily beneficial to these communities.
3. **Provide more flexibility with respect to meeting the low-income threshold**, such as by using data from surrounding census tracts to account for areas that lack data because of their size, and providing a way for communities to identify as disadvantaged if they are environmentally overburdened but above the current income threshold.
4. **Enhance the climate change vulnerability category** by including measures such as heat island risks, trends in extreme temperatures, flood risks, and so on.
5. **Integrate metrics of physical and social infrastructure**. These could include transportation infrastructure, digital infrastructure, banking services, and food security metrics, among others.
6. **Enhance metrics of relevance to community health status**, such as those related to perinatal and maternal health outcomes.
7. **Expand or enhance environmental hazard indicators** to include National Air Toxics Assessment, concentrated animal feeding operations, and oil and gas extraction activities, among others.
8. **Integrate measure of sensitive populations and receptors**, specifically places where individuals are convened, such as schools and prisons.

9. **Add indicators of drinking water quality and sanitation**, such as access to quality drinking water and sanitation services.
10. **Provide a cumulative impact metric** by scaling up or adapting validated methods, such as the CalEnviroScreen.
11. **Provide a more transparent and accessible interface for timely user and community feedback** to help correct data gaps and errors, ground truth data and increase access for non-English speakers.

Catherine Coleman Flowers opened the floor for discussion.

Juan Parras suggested that indicators of structural racism include schools segregation.

Michele Roberts added that there should be an iterative process, it should be scheduled and fully staffed and funded.

Dr. Beverly Wright said she is furious about race not being included. She said that middle class black communities (in New Orleans, specifically) were not appearing, nor were historically black colleges and universities. She asked about variables that related to middle class black communities.

Catherine Coleman Flowers said she lives in an area of HBCUs and noted that these areas are general redlined communities; she asked whether the recommendation to include a redlining measure would capture that. **Beverly Wright** thought it might not capture black communities that were not created by redlining.

Dr. Rachel Morello-Frosch said the workgroup discussed that issue and tried to address it in recommendation #3, and also through the recommendation for increased income and education thresholds. **Dr. Nicky Sheats** added that the recommendations offer a path around the income threshold. **Dr. Rachel Morello-Frosch** added that recommendation 11 is another way for communities to self-identify.

Susana Almanza suggested adding a zoning map, as zoning allowed for redlining and also for industrial development.

Dr. Robert Bullard commented that supposedly race-neutral permitting can result in the concentration of unwanted industry in black and brown neighborhoods. He said the CEJST may identify these disadvantaged neighborhoods, but what will it do to help enforce rights? Some states don't fear any consequences from the federal government.

Dr. Kyle Whyte said that he hopes CEQ takes the recommendation for tribal consultation seriously. In some cases, the results of consultations are summarized and made public, but in other cases they are not made public, he said, and it will be important to track the consultations. He said that data and public information tell a different story than the narrative told by the lived experience of Indigenous people. Because the CEJST is an evolving tool, it presents an opportunity to build relationships so that data alone are not the sole determinants of benefits.

Peggy Shepard asked for more clarity on recommendation #3, providing flexibility regarding the low-income threshold. She suggested phrasing to indicate that the low-income threshold is not a primary threshold.

Dr. Nicky Sheats suggested saying that income should not be a barrier.

Angelo Logan commented that data do not tell the whole picture, and he wants to use data, but not as a barrier. He gave an example of income, which could reflect the outliers, not the actual income of certain neighborhoods. He also noted that cancer clusters may not be accurately reflected in census tracts.

Dr. Beverly Wright said that's why she keeps asking for a process and suggested that it should be required that someone visit places to make sure data are ground-truthed.

Richard Moore said we must be cautious with regards to rural communities so we don't leave them out of the picture. He added that free prior informed consent goes beyond how it is commonly understood by the domestic consultation regime and recognizes tribal rights to influence and consent to any project or legislation that implicates their interests.

Dr. Nicky Sheats said he may contact Angelo Logan regarding new phrasing for the recommendation.

Juan Parras said that some communities need a lot of resources, and he'd like to figure out how to address that, such as by outreach to rural communities to these communities have more information.

Dr. Beverly Wright said that the J40 recommendations specifically make that point.

Viola Waghiyi said she appreciates that the CEJST is a living document. She said regarding "free and informed consent" from UN's Declaration on the Rights of Indigenous People, it's a good mechanism, but it's not legally binding and hasn't worked for them. She said stronger language that acknowledges the right of self-determination for sovereign nations and tribes.

Peggy Shepard requested a motion to accept the recommendations to advance to CEQ and IAC. **Dr. Rachel Morello-Frosch** moved to accept the letter with recommended changes. **Catherine Coleman Flowers** seconded the motion.

The motion passed with 19 in favor, 0 opposed, and 6 members absent.

Incinerator Air Pollution Emissions Limits Proposed Recommendations: Overview and Deliberations

Nicky Sheats and Maria López-Núñez presented the letter on incinerator emissions. (See appendix D, slides 89–90.)

Dr. Nicky Sheats provided background on the letter, reminding attendees that the issue was raised in public comments during the last public meeting. He said incinerators are disproportionately located in environmental justice communities and contribute to numerous types of pollution, especially fine particulate matter, that causes illness and premature death in these communities. He said the Clean Air Act requires a review of incinerator emission limits every five years. However, EPA is 11 years behind reviewing and revising these limits on small incinerators, and 16 behind on large incinerators. That the delay can be measured in illness and death is not just hyperbole, he said. The letter urges CEQ to advise EPA to revise incinerator air pollution limits as quickly as possible.

Maria López-Núñez said that EPA has not been using the authority it was granted under the Clean Air Act to its fullest potential. She suggested the WHEJAC could write letters on other issues raised in public meetings, as well.

Angelo Logan said that this is really about how EPA is perpetuating environmental racism by inaction, and he suggested stronger language. For example, instead of saying CEQ should direct EPA to act, not

request action from EPA. He referred to a 1984 report that targeted black and brown communities as incinerator sites.

Richard Moore agreed with Angelo Logan and said incinerator pollution is not only a legacy issue, but a current issue. **Viola Waghiyi** said agreed on the issue of using the strongest possible language.

Maria López-Núñez clarified the proposed changes. One was using Angelo Logan's suggestion to change "urge" to "direct" and to say in the body of the letter that inaction is environmental racism. Nicky Sheats and Maria López-Núñez agreed to work on that revision immediately.

Michele Roberts moved to accept the letter with revisions, and Beverly Wright seconded. The motion passed with 18 yays, 0 nays; 7 members were absent.

Business Meeting: Reflections and Conversation

Workgroup Updates

Executive Order 12898 Revisions Workgroup

Richard Moore, workgroup chair, said that the workgroup has been “diving very, very deep” and making progress. **Peggy Shepard** added that the EO 12898 workgroup was one that was pressured to work very quickly, which they did last year; she is disappointed the EO hasn’t been approved yet. Angelo Logan said the recommendations are in the hands of the administration and they are expecting a response.

Richard Moore asked for a response from CEQ. Dr. **Jalonne White-Newsome** said that CEQ is waiting, as well, and she will provide an update when possible.

Environmental Justice Scorecard Workgroup

Workgroup co-chair Dr. **Kyle Whyte** reminded everybody that the workgroup had submitted recommendations in the spring but the task of developing a scorecard for all agencies was far beyond the resources afforded the workgroup, so they asked for resources such as technical guidance, and CEQ responded. CEQ recently let the workgroup know that CEQ will handle the majority of the scorecard development. In the meantime, the workgroup is discussing areas for their potential input, such as newer environmental justice risks and issues. He said the workgroup will update the WHEJAC as their direction becomes clearer. Kyle Whyte asked to hear from CEQ.

Dr. Jalonne White-Newsome thanked the workgroup for its patience and for meeting deadlines. She said CEQ issued a request for information with a 60-day window, and she encouraged the WHEJAC to share it widely. She added that CEQ, OMB, and Climate Policy Office (CPO) are now aligned over the scorecard strategy in terms of roles, engaging IAC, and producing a timeline. She said her goal is to get a timeline. She said she hopes to be able to provide more information in late summer or early fall.

Dr. Kyle White remarked on the vast amount of resources and datasets required to make the CEJST, and said that the scorecard is a more complex undertaking. He said he hopes the government can take seriously the level of labor required for the task and ensure investments are equal to the work needed.

Dr. Jalonne White-Newsome said that agencies are the ones who will have to implement the tool, so they should be part of the process of creating it. She iterated that it’s the first scorecard and will capture a baseline.

Michele Roberts said that 60 days is not a long enough period for comments and asked CEQ to consider extending it.

Dr. Beverly Wright asked why the letter going to CEQ regarding the incinerators can’t be sent directly to EPA. **Victoria Robinson** said the WHEJAC is chartered to advise CEQ and IAC; however, EPA is a member of IAC. The WHEJAC products need to flow through the formal process. Victoria Robinson said they are and have always been free to reach out to the administrator as individuals. **Dr. Beverly Wright** said it takes a long time to get information from CEQ, so she would like to alert the administrator directly about what is or is not happening outside of the WHEJAC process.

Dr. Kyle Whyte said the work of the scorecard is as big as a truth and reconciliation effort and should be elevated to that status. It’s a massive human rights endeavor.

Angelo Logan asked if the need for increased capacity is included. **Peggy Shepard** said it is included in the Justice40 recommendations.

Indigenous Peoples and Tribal Nations Workgroup

Viola Waghiyi asked that her name be added to the list of workgroup members named on the slide deck.

Dr. Kyle White said that the workgroup is about to finalize its new meeting times and start meeting again. The group will finalize its description and begin working on some of the projects members identified. The group sent its proposed language back to CEQ and hopes to have more specific updates at the next meeting. He said there are many diverse Indigenous people experiencing injustice and the right to self-determination is a human right. He said that the U.S. recognizes tribal nations, but people also have rights as citizens of the United States and as individuals. The workgroup hopes to address issues that currently are not being addressed. Regarding consultations, he said the Biden Administration has done more consultations than the Obama Administration did its entire term, but tribes and Indigenous people are now overwhelmed with consultation and are receiving more information about issues that will affect their health and well-being than they have the capacity to respond to.

Climate Resilience Workgroup

Workgroup Co-chair **Miya Yoshitani** said the workgroup had been given a list of charge questions, and members were asked to provide recommendations on the first three questions by now. The group had come up with recommendations mostly pertinent to FEMA but felt they need additional capacity and research, including direct contact with about 10 federal agencies. The workgroup is working on the first set of recommendations now and setting up meetings with individual agencies, and it will have recommendations to the remaining charge questions completed in December.

Co-chair **Maria López-Núñez** added that the framing of the charge questions suggests that uninsured communities are the target of intervention—the object to be “fixed”—as opposed to the agencies and policies.

Michele Roberts said the State Department has information that the workgroup could consult so it wouldn't have to start from scratch.

Viola Waghiyi asked to be informed of the workgroup's next meeting.

Reflections

Peggy Shepard asked if the members had any reflections to share on the days' events.

Viola Waghiyi thanked those who made public comments and said they were heard. She said she wants them to know that the workgroup is looking for solutions and meaningful change. She asked CEQ whether members from IAC attended to hear public comments. **Dr. Jalonnie White-Newsome** said they do listen and track, and she can share that list.

Maria López-Núñez said the day's conversation has reminded her of the need for strong language to meet the urgency of the moment. She said their communities wake up every day to bad news, and much of the harm being done to communities is greenwashed. She said she hopes the WHEJAC can be a point of moral clarity and send a strong message to the Administration and to CEQ.

Angelo Logan asked for clarity on the process regarding public comment. He said currently individuals are asked to sign up for public comment before the agenda is posted online. He asked if the process could be made more meaningful. **Victoria Robinson** said they are working to improve the process within specific constraints, such as the need to post the meeting notice in the Federal Register a

minimum of 15 days in advance. She said they will look at how to have the agenda ready so it can be posted near to when the Federal Register notice is posted.

Maria Belen Power said she feels as if they have been grappling with the issue of how to address public comments for months. She said the experience of some members of the public of making the same comment over and over again would feel frustrating. She said that public comments were going to be categorized. She said the WHEJAC could be lifting up some of these issues. She asked where they are with categorizing the comments.

Michele Roberts said the alignment among CEQ, OMB, and CPO is critical and said that transformative change is needed if public comments are to be meaningful.

Ruth Santiago said that they heard yesterday that CCUS, hydrogen, and other questionable technologies are covered under the Justice40 initiative. She asked why they are covered, given that they are not benefits to communities. She said that they were told the Biden Administration has to make compromises for bills such as the Inflation Reduction Bill, but compromises don't have to be made for what is covered by Justice40 and she believes they should be excluded. She would like clarification if that is not the case.

In addition, **Ruth Santiago** said she was asked to review the slides for the J40 presentation, but when she submitted her comment, she was told that the change could not be made without consultation. However, she said there was no opposition from other WHEJAC members, so she sees it as an attempt to control or censor speech and not give the issue the projection they wanted it to have in the slides for the public meeting. She said the issue is the problematic deals the Biden Administration is making to promote oil and gas drilling in the Gulf Coast, Alaska, and elsewhere. She said we are here to make recommendations; we made them, and we want them included in the public meeting.

Dr. Nicky Sheats said he agrees with Ruth Santiago and that if CCS has to be a government-funded program, at least keep it out of Justice40 and include only the things they all agree will benefit communities.

Dr. Kyle Whyte said that in other FACAs he has been involved in, the committees receive detailed spreadsheets of every comment, which allows the committee to categorize them and look for patterns, and to develop responses and ideas, whether comments are from the public or government agencies. He said the documentation is critical for accountability. He said it would be a shame if this major civil rights inquiry did not produce the documentation that would respect the gravity of the work. He said other FACA processes have paid that level of respect to public comments.

Juan Parras said that he would like to see accountability from regional administrators and regulators regarding environmental justice issues. He would like to figure out how to make regulators address their issues.

Closing Remarks and Adjourn

Richard Moore flagged the intention to have more interaction between the Chairs of the WHEJAC and those of the NEJAC. He also raised the need to move issues (such as managing public comments) forward between meetings. He mentioned a recent meeting in Washington, DC, in which WHEJAC chairs met with agencies. He said the chairs and vice chairs will take up some of these issues and that CEQ staff has been working hard to help them figure out where to go from here regarding public comments.

Peggy Shepard said the meeting in Washington, DC, made clear that agencies were eager to talk about what they were doing and to hear from the WHEJAC, so she's looking forward to a face-to-face meeting in December to develop relationships. She then summarized the main action items, which were to advance the recommendations discussed.

Victoria Robinson added that members time ran out to address all the questions from the carbon management discussion, so she would compile the unanswered question. If some questions were not voiced, members should send them to her by COB August 5.

Peggy Shepard noted the passion and commitment that the WHEJAC puts into its work, and she thanked everybody for it. She said they've been doing great work with an intensity that has lasted almost two years. They are taking on new mandates, as well. She said she hopes new leadership and more staffing at CEQ will help advance the work faster and more efficiently than in the past.

Richard Moore thanked the staff for helping the WHEJAC get to where they are. He thanked the interpreters and closed captioner. He thanked the WHEJAC members, co-chairs and those, who made public comments and listened in on the call.

Dr. Jalonne White-Newsome said they have their work cut out. She said she can't change the past, but she is embracing future opportunities. She thanked the WHEJAC chairs, co-chairs, and members for their robust and explicit recommendations. She thanked the agencies in attendance, as well as the DFO and EPA staff. She also thanked the public commenters and attendees. In response to an earlier question from Carletta Tilousi [on how funds will be available to tribes], she said that J40 is not a new pot of money; it's an initiative and agencies will use monies that they already have, so if a tribe is already getting funds, there is nothing else it needs to do.

Regarding the scorecard, Dr. White-Newsome said that she appreciates the emphasis on capacity and will get back to the WHEJAC as they create the inclusive process. She said she will take Michele Robert's request to extend the RFI comment period up to 90 days.

Thirdly, Dr. White-Newsome thanked Dr. Sheats and Maria López-Núñez for bringing up the issue of the low-hanging fruit regarding the incinerator. She said she wants to be able to figure out how to bring up issues shared in the past. She said the next steps for her team is processing all the information. She said the EJ team has been capturing all the comments and organizing them into a spreadsheet, so she should be able to share with the WHEJAC soon. She said she would like to hear from the WHEJAC on some best practices to utilize it. CEQ will convene the agencies again to figure out the best process to implement.

Dr. White-Newsome said she hears the WHEJAC, and she takes to heart their comments about principles and process and priorities. She said she wants to see transformation and is committed to that. She thanked them for showing up not only for CEQ, but for the country.

Victoria Robinson thanked everybody and reiterated ways to make public comment.

Victoria Robinson adjourned the meeting.

###

I, Richard Moore, Co-Chair of the White House Environmental Justice Advisory Council, certify that this is the final meeting summary for the public meeting held on August 3-4, 2022, and it accurately reflects the discussions and decisions of the meeting.



Richard Moore

I, Peggy Shepard, Co-Chair of the White House Environmental Justice Advisory Council, certify that this is the final meeting summary for the public meeting held on August 3-4, 2022, and it accurately reflects the discussions and decisions of the meeting.



Peggy Shepard

Appendix A Federal Register Notice

6560-50-P

ENVIRONMENTAL PROTECTION AGENCY

[FRL-9989-01-OA; EPA-HQ-OA-2022-0050]

White House Environmental Justice Advisory Council; Notification of Virtual Public Meeting

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notification for a public meeting.

SUMMARY: Pursuant to the Federal Advisory Committee Act (FACA), the U.S. Environmental Protection Agency (EPA) hereby provides notice that the White House Environmental Justice Advisory Council (WHEJAC) will meet on the dates and times described below. The meeting is open to the public. Members of the public are encouraged to provide comments relevant to federal disaster preparedness and relief and community resilience. For additional information about registering to attend the meetings or to provide public comment, please see “**REGISTRATION**” under “**SUPPLEMENTARY INFORMATION**.” Pre-registration is required.

DATES: The WHEJAC will hold a virtual public meeting on Wednesday, August 3, 2022, and Thursday, August 4, 2022, from approximately 3:00 pm – 7:30 pm, Eastern Time, each day. A public comment period relevant to the development of an annual public performance scorecard and the types of indicators or data that would be useful in a scorecard will be considered by the WHEJAC during the meeting on August 3, 2022. (see **SUPPLEMENTARY INFORMATION**). Members of the public who wish to participate during the public comment period must pre-register by 11:59 p.m., Eastern Time, July 27, 2022.

FOR FURTHER INFORMATION CONTACT: Victoria Robinson, WHEJAC Designated Federal Officer, U.S. EPA; email: whejac@epa.gov; telephone: (202) 564-6349. Additional information about the WHEJAC is available at <https://www.epa.gov/environmentaljustice/white-house-environmental-justice-advisory-council>.

SUPPLEMENTARY INFORMATION: The meeting discussion will focus on draft recommendations related to climate resilience, the beta version of the Climate and Economic Justice Screening Tool, and the implementation of the Justice40 Initiative.

The Charter of the WHEJAC states that the advisory committee will provide independent advice and recommendations to the Chair of the CEQ and to the White House Environmental Justice Interagency Council (IAC). The WHEJAC will provide advice and recommendations about broad cross-cutting issues, related but not limited to, issues of environmental justice and pollution reduction, energy, climate change mitigation and resiliency, environmental health, and racial inequity. The WHEJAC’s efforts will include a broad range of strategic, scientific, technological, regulatory, community engagement, and economic issues related to environmental justice.

Registration: Individual registration is required for the virtual public meeting. Information on how to register is located at <https://www.epa.gov/environmentaljustice/white-house-environmental-justice-advisory-council>. Registration for the meeting is available through the scheduled end time of the meeting. Registration to speak during the public comment period will close 11:59 p.m., Eastern Time, on July 27, 2022. When registering, please provide your name, organization, city and state, and email address for follow up. Please also indicate whether you would like to provide public comment during the meeting, and whether you are submitting written comments at the time of registration.

A. Public Comment

The WHEJAC is interested in receiving public comments specific to the development of an annual public performance scorecard and the types of indicators or data that would be useful in a scorecard. This scorecard will provide a method for evaluation and accountability to assess the Federal Government's progress in addressing current and historic environmental injustice. Every effort will be made to hear from as many registered public commenters during the time specified on the agenda. Individuals or groups making remarks during the public comment period will be limited to three (3) minutes. Please be prepared to briefly describe your issue and what you want the WHEJAC to advise CEQ and IAC to do. Submitting written comments for the record are strongly encouraged. You can submit your written comments in three different ways, 1.) by creating comments in the Docket ID No. EPA-HQ-OA-2022-0050 at <http://www.regulations.gov>, 2.) by using the webform at <https://www.epa.gov/environmentaljustice/forms/white-house-environmental-justice-advisory-council-whejac-public-comment>, and 3.) by sending comments via email to whejac@epa.gov. Written comments can be submitted through August 18, 2022.

B. Information about Services for Individuals with Disabilities or Requiring English Language Translation Assistance

For information about access or services for individuals requiring assistance, please contact Victoria Robinson via email at whejac@epa.gov or contact by phone at (202) 564-6349. To request special accommodations for a disability or other assistance, please submit your request at least seven (7) working days prior to the meeting, to give EPA sufficient time to process your request. All requests should be sent to the email listed in the **FOR FURTHER INFORMATION CONTACT** section.

Matthew Tejada,
Director for the EPA Office of Environmental Justice.

Appendix B Agenda



WHITE HOUSE ENVIRONMENTAL JUSTICE ADVISORY COUNCIL

Virtual Public Meeting

August 3, 2022

AGENDA

Wednesday, August 3, 2022

- 3:00 p.m. INTRODUCTIONS AND OPENING REMARKS**
- **Victoria Robinson**, Designated Federal Officer – U.S. Environmental Protection Agency
 - **Richard Moore**, White House Environmental Justice Council Co-Chair – Los Jardines Institute
 - **Peggy Shepard**, White House Environmental Justice Council Co-Chair – WE ACT for Environmental Justice
 - **Catherine Coleman Flowers**, White House Environmental Justice Council Vice Chair – Center for Rural Enterprise and Environmental Justice
 - **Carletta Tilousi**, White House Environmental Justice Council Vice Chair – Havasupai Tribe
- 3:15 p.m. CEQ REMARKS**
- **Dr. Jalonne L. White-Newsome**, Senior Director for Environmental Justice, Council on Environmental Quality
- 3:45 p.m. Carbon Management and Justice⁴⁰**
- **Shalanda H. Baker**, Secretarial Advisor on Equity and Director of the Office of Economic Impact and Diversity, U.S. Department of Energy
 - **Jennifer Wilcox**, Principal Deputy Assistant Secretary, Office of Fossil Energy and Carbon Management, U.S. Department of Energy
 - **Noah Deich**, Deputy Assistant Secretary, Office of Carbon Management, U.S. Department of Energy
 - **Holly Buck**, Management and Program Analyst, Office of Carbon Management, U.S. Department of Energy
- 4:45 p.m. BREAK**
- 5:00 p.m. PUBLIC COMMENT**
- Members of the public will be given three (3) minutes to present comments relevant to the development of an annual public performance EJ scorecard, and the types of indicators or data that would be useful in an EJ scorecard*
- 7:30 p.m. ADJOURN FOR THE DAY**



WHITE HOUSE ENVIRONMENTAL JUSTICE ADVISORY COUNCIL
Virtual Public Meeting
August 4, 2022

AGENDA

Thursday, August 4, 2022

- 3:00 p.m. INTRODUCTIONS**
- **Victoria Robinson**, Designated Federal Officer – U.S. Environmental Protection Agency
- 3:15 p.m. CEQ REMARKS**
- **Brenda Mallory**, Chair, Council on Environmental Quality
- 3:30 pm J40 WG PROPOSED RECOMMENDATIONS: OVERVIEW AND DELIBERATIONS**
- **Peggy Shepard**, J40 WG Co-Chair – WE ACT for Environmental Justice
 - **Beverly Wright**, J40 WG Co-Chair – Deep South Center for Environmental Justice
- 4:15 p.m. BREAK**
- 4:30 p.m. CEJST PROPOSED RECOMMENDATIONS: OVERVIEW AND DELIBERATIONS**
- **Catherine Coleman-Flowers**, CEJST WG Chair – Center for Rural Enterprise and Environmental Justice
 - **Rachel Morello-Frosch**, CEJST WG member – University of California Berkeley
 - **Nicky Sheats**, CEJST WG member – Kean University
- 5:30 P.M. INCINERATOR AIR POLLUTION EMISSIONS LIMITS PROPOSED RECOMMENDATIONS: OVERVIEW & DELIBERATIONS**
- **Nicky Sheats**, Kean University
 - **Maria Lopez-Nunez**, Ironbound Community
- 6:00 p.m. BUSINESS MEETING: REFLECTIONS AND CONVERSATION**
- Other Workgroup Updates
 - Next Steps/Action Items
- 7:00 P.M. CLOSING REMARKS and ADJOURN**
- **Peggy Shepard**, White House Environmental Justice Council Co-Chair – WE ACT for Environmental Justice
 - **Richard Moore**, White House Environmental Justice Council Co-Chair – Los Jardines Institute
 - **Catherine Coleman Flowers**, White House Environmental Justice Council Vice Chair – Center for Rural Enterprise and Environmental Justice
 - **Carletta Tilousi**, White House Environmental Justice Council Vice Chair – Havasupai Tribe
 - **Jalonne White-Newsome**, Senior Advisor for Environmental Justice – The Council on Environmental Quality
 - **Victoria Robinson**, Designated Federal Officer – U.S. Environmental Protection Agency

Appendix C Attendee List

WHEJAC Public Meeting Attendee List August 3-4, 2022

First	Last	Organization
Denise	Abdul-Rahman	Indiana NAACP
Charmagne	Ackerman	US EPA
Astrika	Adams	SBA OA
Sara	Adelsberg	Deloitte
Melodie	Aduja	Health Committee of the Democratic Party of Hawai'i
Stacy	Allen	Ameren
Shantha	Alonso	Dol
Carlo	Altman	USDA-NRCS
Susan	Alzner	shift7
Shanika	Amarakoon	ERG
Whitney	Amaya	East Yard Communities for Environmental Justice
Donald	Ami	DOE/NNSA/Los Alamos Field Office
Kala	Amos	U.S. Government Accountability Office
Carlos	Anchondo	E&E News
Scott	Andrews	Aclima Inc.
Tana-Isabela	Anulacion	EPA
Elsie	Aquino	Atlantic Climate Justice Alliance (ACJA)
Maria	Arevalo Gonzalez	US EPA
Dave	Arndt	Private Citizen
Michael	Atchie	Williams
Carol	Austin	Canfor Southern Pine
Alberto	Ayala	Sacramento Metropolitan Air Quality Manage district
Bronson	Azama	Hawaiian Kingdom
K	B	University
Brent	Baggaley	Houston Independent School District
Sabrina	Bailey	Illinois EPA
Summer	Bain	Deloitte
Caitlin	Baird	TVA
Christina	Baladis	Stanford
Laura	Ballard	WY DEQ
Emmanuel	Balogun	Stanford University
Brad	Banks	MPSC
Nastassia	Barnes	FEMA
Chelsea	Barnes	Appalachian Voices
Catie	Bartone	Weston & Sampson
Sean	Bath	Private Citizen
Jeremiah	Baumann	US Dept of Energy
Jaimie	Baxter	Western Washington University
Chrystal	Beasley	Earthworks

First	Last	Organization
Regine C.	Beauboeuf	HNTB
Nancy	Beck	HuntonAK
Kathleen	Bell	US EPA Region 2
Tannya	Benavides	Commission Shift
Denise	Bennett	Louisiana Department of Environmental Quality
Crystal	Bergemann	HUD
Laura	Betts	The CLEO Institute
Michaela	Bevillard	Haley & Aldrich
Genie	Bey	NOAA Climate Program Office
Karen	Biestman	Stanford University Native American Studies
Stephanie	Bilenko	Nuclear Energy Information Service
Victoria	Blackwell	NCDOT
Michael	Blair	Innovate Inc
Karen	Blakelock	US Climate Alliance
Lana	Bluege	Burns & McDonnell
Coline	Bodenreider	Public Health Alliance of Southern California
Tad	Bohannon	Central Arkansas Water
Jessica	Borden	Student
Sara	Bossenbroek	Eastern Research Group, Inc. (ERG),
John	Boyd	National Black Farmers Association
Kara	Boyd	Association of American Indian Farmers
Haley	Brennan	University of Connecticut
Evelyn	Britton	U.S. General Services Administration
Emily	Brooks	USGS
Brandy	Brooks	Radical Solutions LLC
Janice	Brown	Private Citizen
ErNiko	Brown	OURS
Lucas	Brown	CEQ
Kelsey	Brugger	E&E News
Doug	Brune	EPA Region 7
Kyle	Bryant	EPA - R4
Sharunda	Buchanan	CDC/ATSDR
Bella	Bucheli	Packard Foundation
Stephen	Buckley	Private Citizen
John G. Buddy	Buddy	Old Bedford Village Development, Inc.
Carson	Bullock	American Academy of Arts and Sciences
Irene	Burga	GreenLatinos
Zuri	Burns	Private Citizen
ADRIANE	BUSBY	Friends of the Earth
Chelsea	Busick	Valley Water
Regina	Butler	AFCEC/CZOE
Jared	Bynum	Conservation Colorado
Lance	Caldwell	U.S. EPA Region 2
Karen	campblin	ktcPLAN

First	Last	Organization
Katherine	Cann	Rutgers University
Morgan	Capilla	US EPA
Jill	Capotosto	DOE
Kate	Carter	American Academy of Arts and Sciences
Alec	Castellano	Catholic Charities of the Diocese of Stockton
Karina	Castillo	Miami-Dade County
Layale	chaker	Private Citizen
Brian	Chalfant	Pennsylvania Department of Environmental Protection
Mark	Chambers	Stony Brook University
Elizabeth	Chan	EPA
Sophia	Charan	American Academy of Arts & Sciences
Amelia	Cheek	Illinois Environmental Regulatory Group
Sylvia	Chi	Just Solutions Collective
Eric	Choi	GHGSat Inc.
Samir	Chowdhury	EOP/CEQ
Theo	Cielos	Washington State Environmental Justice Council
Catherine	Clark	FEMA
Jenn	Clarke	City of Richmond
Jonathan	Cohen	DOE
Kimberlie	Cole	UCOR LLC/Strata-G LLC
Jorge	Colón	University of Puerto Rico at Río Piedras
Rachel	Connolly	UCLA
Marisol	Consuegra Prado	University of Miami
Annie	Contractor	RuralOrganizing.org Education Fund
Myrna	Conty	Amigos del Río Guaynabo
Lisa	Cooke	FAA
Caren	Cooper	North Carolina State University
Laurie	Cooper	USDA Forest Service
Nicole	Cordan	EOP/OMB
Patrice	Courtney Strong	Arch Street Communications
Nikki	Cox	USDA Forest Service
Bria	Crawford	Environmental Protection Agency
Brandi	Crawford-Johnson	EJ Activist
Jasmine	Crenshaw	Earthjustice
Nicole	Cropper	California Department of Fish and Wildlife
Matthew	Cross-Guillen	NM Dept of Health
Jonathan	Cruz	Multnomah County Health Department
Marina	Cucuzza	USGS
Anita	Cunningham	Robeson County Coop for Sustainable Development
Rebecca	Curry	Earthjustice
Alicia	Daniels-Lewis	USEPA
Annette	Darden	Stop EtO in Lake County
LaShaya D.	Darisaw MPA	TNT Consulting
Bryan	Davidson	Tennessee Department of Environment and Conservation

First	Last	Organization
Dawn	Davis	INL
Jesse	Deer In Water	CRAFT
Dionne	Delli-Gatti	EDF
Chloe	Desir	Ironbound Community Corporation
Michael	Dexter	SSDN
Erin	Diehl	City of Dallas, Environmental Quality & Sustainability
Rami	Dinnawi	El Puente De Williamsburg
Christine	Dobny	Fred A. and Barbara M. Erb Family Foundation
N.	Dobson	Dept. of Energy
John	DOHERTY	IUPAT
Rachel	Donkersloot	Lake and Pen
Cecelia	Donovan	EcoLogix Group, Inc.
Andrea	Dorch	City of Kansas City MO / Civil Rights Dept
Kristin	Dortch	Centers for Disease Control - Atlanta, GA
Lori	Dowil	Corteva
Melinda	Downing	Department of Energy
Linda	Durril	Fort Wayne (IN) NAACP
Jeannie	Economos	Farmworker Association of Florida
Farron	Edmonds	Partnership for Southern Equity
Ellen	Ellen	Galileo Project LLC
Tania	Ellersick	USDA Forest Service
Lena	Epps-Price	US EPA
Serap	Erdal	University of Illinois-Chicago School of Public Health
Neeraja	Erraguntla	American Chemistry Council
John	Esch	Michigan EGLE
Monica	Espinosa	EPA Region 7
Michelle	Ethun	DOT
Marian	Evans	Southern Connecticut State University
Jaxon	Fagan	Colorado Energy Office
Angie	Fan	Healthy Port Communities Coalition
Ericka	Farrell	EPA
Rolando	Favela	The Southwest Collective
Robert	Feeman	DLA Installation Management for Distribution
Alexandra	Feitel	US EPA
Cynthia	Ferguson	US DOJ Office of EJ
Nicolette	Fertakis	EPA
Timothy	Fields	MDB, Inc.
Chelsea	Fisher	Canfor Southern Pine
Megan	Fitzsimmons	Texas Tech University Health Science Center
Sarah	Forbes	CEQ
Dr. Frederick	Forde	Midwest Building Decarbonization Coalition
Cassandra	Forsyth	USACE
Michelle	Fox	US DOE
Denise	Freeman	U.S. Dept. of Energy

First	Last	Organization
Thomas	Frey	MDE
Kate	Friedman	Louisiana Department of Health
Hannah	Friedrich	University of Arizona
Jan Marie	Fritz	U. of Cincinnati/U. of Johannesburg
Nancy	Frost	Great Old Broads for Wilderness
Ashley	Fuller	EGLE
Bernard	Gallagher	Center on Budget and Policy Priorities
Emily	Gallo	HNTB
Eleonor	Garcia	Georgetown Climate Center
Tracy	Garland	Resilient Virginia
Treva	Gear	Concerned Citizens of Cook County
Andrew	Geller	US EPA
Andrew	George	UNC Chapel Hill Institute for the Environment
Laurie	Gharis	TCEQ
Ora	Giles	Transcription, Etc., LLC
Linda	Giles	Transcription Etc
Angela	Glass	AFCEC
Jamie	Gobreski	EPA
Daniel	Gogal	USEPA/Office of Environmental Justice
Leo	Goldsmith	ICF
Catalina	Gonzalez	Center for Progressive Reform
Nelson	Sullow	USDA-Forest Service
Vanessa	Gordon	USDA
Susan	Gorman-Chang	Environ Justice Task Force for Faith Action
Ariel	Gould	Good energy collective
Genesis	Granados	Air Alliance Houston
Eugene	Green	U.S. EPA
Lena	Green	NAACP/Comm'ty Advocate
Matthew	Greene	U.S. Fish and Wildlife Service
Ardie	Griffin	Emerald Cities Collaborative
Elisabeth	Grinspoon	USDA
Lynn	Grosso	HUD
Emily	Gulick	Jacobs
Chris	Gunn	U.S. Department of Energy
Rose	Gutowski	FEMA
Tafadzwa	Gwitira	Farm Based Education Network
Jennifer	Hadayia	Air Alliance Houston
Laura	Haider	Fresnans Against Fracking
Betsy	Hale	KCPS
Brandi	Hall	ADOT
Rachel	Halpern	USDOE
Jennifer	Hamad	Office of Senator Josh Becker
Stephanie	Hammonds	WVDEP-DAQ
Rose	Hanks	LSU

First	Last	Organization
Gina	Hara	Oahu Water Protector
Joy	Harasemay	MoveOn Volunteer WOC Advisory Committee
Leah	Harnish	American Waterways Operators
Pamela	Harris	Maryland Department of the Environment
Mia	Harris	Exelon
Sarah	Harrison	EPA
Charlie	Hart	GSA PBS
Jennifer	Hass	DHS
Keith	Hay	Colorado Energy Office
Celestine	Hayes	Council Woman
Rusty	Hazelton	USEPA
Terrie	Henderson	Angel Land
Sulma	Hernandez	South Los Angeles Transit Empowerment Zone
Stephanie	Herron	EJHA
Azania	Heyward-James	The Cornerstone Collective 2020 and Damê Consultants
Nalleli	Hidalgo	TEJAS
Bryan	Hinterberger	ODASD (E&ER)
Liz	Hoerning	EHS Support
Alexandra	Holland	Climate Reality - DFW TX Chapter
Matt	Holmes	Little Manila Rising
Danyelle	Holmes	MS Poor People's Campaign
Brian	Holtzclaw	US EPA
Russel	Honore	Green Army
Janice	Horn	Tennessee Valley Authority
Melissa	Horton	Southern Company
James	Hove	U.S. Department of Transportation
BJ	Howerton	DOI-BIA
Wendy	Huber	BLM
Brandon	Hunter	Center for Rural Enterprise & Environmental Justice
Erica	Iannotti	Deloitte
Lee	Ilan	NYC Mayor's Office of Environmental Remediation
Michelle	Insignares	SCSU
Marnese	Jackson	Midwest Building Decarbonization Coalition
Cale	Jaffe	University of Virginia School of Law
Anjuli	Jain Figueroa	DOE
Ashley	James	EPA
William	James	US Army Corps of Engineers
Catrice	Jefferson	EPA
Tyler	Jenkins	Senate EPW
Doris	Johnson	Energy & Environmental Protection
Tara	Johnson	US EPA
Sabrina	Johnson	US EPA
Susan	Johnson	USDA Forest Service
Danny	Johnson	SWPA

First	Last	Organization
Bonita	Johnson	USEPA
Natasha	Johnson-Griffin	NASA intern
Kim	Jones	EPA
Elizabeth	Jones	Private Citizen
Jace	Jones	Private Citizen
Michelle	Jung	United Nations Foundation
Danyel	Kahumoku	ICF
Jeff	Keller	WWPI
Hannah	Kelley	Private Citizen
Cheryl	Kelly	U.S. Department of the Interior
Danielle	Kelton Sopko	Private Citizen
kameron	kerger	U.S. Digital Service
Nneka	Kibuule	Aligned Climate Capital
Lee	Killinger	Florida Crystals
Marva	King	EPA Retiree
Denae	King	Texas Southern University
John	Kinsman	Edison Electric Institute
Sarah	Kirkle	Texas Water Conservation Association
Hannah	Klaus	Maryland Carey Law School
Theresa	Kliczewski	U.S. Dept of Energy
Renee	Kramer	North Carolina Department of Environmental Quality
Ani	Krishnan	City of Seattle
Stephanie	Kuhns	Bureau of Land Management
Emma	Kurnat-Thoma	Georgetown University NHS
Kim	Lambert	U.S. Fish and Wildlife Service
Katie	Lambeth	EGLE
Meghan	Langley	City Point Outreach
Krystal	Laymon	WH
Erica	Le Doux	US Environmental Protection Agency
Philip	Lee	Gulf of Mexico Division
Karen	Lee	Democrats Abroad Greece
Julie	Lemay	Gradient
Leo	Lentsch	Civil and Environmental Consultants
Sarah	Leung	DOE
Candace	Lewis	EPA
Robin	Lisowski	Slipstream
C	Liv	HHS
Diedre	Lloyd	EPA
Tasha	Lo Porto	US Forest Service
Ryke	Longest	Duke School of Law
Kelly	Longfellow	DoDEA
Olivia	Lopez	Ocean Conservancy
Dowil,	Lori	Corteva
Laquita	Lozano	AFCEC/CZR

First	Last	Organization
Sonrisa	Lucero	DOE
Adonia	Lugo	UCLA
Andrea	Luna	The Los Angeles Neighborhood Land Trust
Ziyuan	Ma	UConn Student
Richard	Mabion	Building A Sustainable Earth C
Caitlin	Macomber	WRI
Nora	Madonick	Arch Street Communications
Lori	Manes	NOREAS Inc
Cynthia	Manfred	Guarda Rio
Sara	Mangan	Farmworker Association of Florida
Li-Ya	Mar	The Climate Reality Project - Dallas Fort Worth Chapter
Sandy	Marin	USDA Forest Service
Sophia	Marjanovic	Union of Concerned Scientists
Larissa	Mark	EPA
Chris	Marks	Arizona Department of Environmental Quality
Janette	Marsh	US EPA Region 5
Mike	Martinez	Department of the Interior
Sofia	Martinez	Concerned Citizens of Wagon Mound and Mora County
Michael	Martinez	US Dept of the Interior
Brendan	Mascarenhas	ACC
Arsenio	Mataka (HHS)	HHS
Narjes	Mathlouthi	UCSB
Audrey	Matsumonji	USDA Forest Service
Swati	Maurya	Stanford University
Eileen	Mayer	US EPA
Zulene	Mayfield	Chester Residents Concerned for Quality Living
Liz	McCarthy	EPA
Christine	McCarthy	The Portland Cement Association
Wendy	McCarville	USAF
Allen	McGill	Private Citizen
Caitlin	McHale	National Mining Association
Shannon	McNeeley	Pacific Institute
Douglas	Meiklejohn	Conservation Voters New Mexico
Liat	Meitzenheimer	Fresh Air Vallejo
Johnny	Mendoza	USDA NRCS
Haylee	Mendoza	Private Citizen
Danielle	Mercurio	VNF
Nichole	Merris	Climate Reality Project
Erin	Meyer	UC Merced
Adam	Micciche	Deloitte
Erin	Middleton	Carbon Solutions LLC
Julia S.	Mignucci	Mayaguezanos Por La Salud y el Ambiente
Kathryn	Millard	US EPA
Mike	Miller	TCEQ

First	Last	Organization
Ty	Mills	MWCS
Darya	Minovi	Union of Concerned Scientists
Barb	Miranda	USDA-Forest Service
Katherine	Mlika	U.S. Digital Service
Alessandro	Molina	EPA
Ed	Monachino	RTI International
Olivia	Morgan	Private Citizen
Hope	Morgan	AECOM
Brie	Morris	Green Thumbs for Black Power
John	Mueller	Private citizen
Ayako	Nagano	Private Citizen
Ana	Navarro	Sea Grant Puerto Rico
Daria	Neal	U.S. Dept. of Justice
Lin	Nelson	Evergreen State College
Christopher	Nelson	NOAA
Carolyn	Nelson	DOT-FHWA
VAYLA	New Orleans	VAYLA New Orleans
Michelle	Ng	Stanford University
Loan	Nguyen	US EPA
William	Nichols	US EPA
Julie	Nicholson	EPA
Irene	Norville	U.S. Department of Energy
Avriel	Null	Tennessee Valley Authority
Ngozi	Nwosu	City of Dallas
Maya	Nye	Coming Clean
Laura	Olah	Citizens for Safe Water Around Badger (CSWAB.org)
Melanie	Oldham	Citizens for Clean Air and Water in Brazoria County
Tannya	Oliva	MALC
JOHN	OLUWALEYE	Gender-Based violence as a public Health Issue
Frankie	Orona	Society of Native Nations
Donald	Osborne	Fresh Air Vallejo
Pam	Overman	US EPA
Kelsey	Owens	US Department of Transportation
Altheia	Paige	Concerned Citizen of Cook County
Shail	Pandya	Tetra Tech
Philip	Parker	EPA
Ana	Parras	Texas Environmental Justice Advocacy Services
Paresh	Patel	e ² =equitable energy
Rachel	Patterson	Private Citizen
Drue	Pearce	Holland & Hart LLP
Dorothy	Peña	For the Greater Good
Nestor	Perez	Earthjustice
Pamela	Perez	California State University, Northridge
Deja	Perkins	North Carolina State University

First	Last	Organization
Kandycy	Perry	NJ Department of Environmental Protection
Christopher	Pettinato	Columbia University
Pamela	Pettyjohn	Coney Island Beautification Project
Cynthia	Peurifoy	Private Citizen
Frederick	Pfaeffle	Department of Energy
Linda	Phan	Air Alliance Houston
Robyn	Polinsky	US EPA R4
Lydia	Ponce	Society of Native Nations
Hilary	Poore	CEC
Alex	Porteous	U.S. EPA
Kimberly	Post	Saint Joseph's College
Dr. Junius	Pressey	Heaven Ministries International
Andrea	Price	EPA
Barbie	Prine	Navy
Jonathan	Pruitt	Catholic Charities Diocese of Stockton
Theresa	Pugh	NAM
Tarique	Rashaud	WM Inc.
Elise	Rasmussen	Washington State Department of Health
Kielan	Rathjen	EPA - Intern
Tony	Reames	Department of Energy
Shawnta	Reed	FairShake ELS
Dawn	Reeves	Inside EPA
Eloise	Reid	UVM
Sean	Reilly	E&E News
Michael	Reiner	DOE
Maria	Reyes	Cassell
José	Reyna	GreenHome Institute
Aline	Reynolds	Government Agency
Charissee	Ridgeway	CEQ
Deanee	Rios	Atlantic Climate Justice Alliance
Maria	Rivera	Colegio de Químicos de Puerto Rico
LaKeshia	Robertson	EPA
Christina	Robichaud	US EPA
Donzell	Robinson	Justice and Sustainability Associates, LLC
Victoria	Robinson	Private Citizen
Gabriela	Rodriguez	DOE
Michelle	Rogat	City of Albany Office of Sustainability
Shannon	Romeling	Amigos Bravos
Sary	Rosario	El Puente / Faith Committee
Ron	Ross	Northwood Estates Community Org
Toni	Rousey	Federal Advisory Committee Management Division
Elsa	Saade	Private Citizen
Hayley	Sakwa	Elevate
Andrea	Salazar	Michaels Energy

First	Last	Organization
Blanca	Sanchez-Cruz	Valley Water
Stacie	Sanders	Housing Oregon
Maria	Santiago	Atlantic Climate Justice Alliance
Denise	Sarchiapone	B&D Environmental Consulting LLC
Oral	Saulters	Tribal TAB
Theodora	Scarato	Environmental Health Trust
Rachel	Schneider	DHS/CBP
Glenn	Schroeder	U.S. Department of the Interior
Forrest	Schultz	Bell Lumber and Pole Co
Dean	Scott	Bloomberg
Gaby	Seltzer	City of Seattle
Mario	Sengco	U.S. EPA
Dawud	Shabaka	Harambee House, Inc.
Nayyirah	Shariff	Flint Rising
Natalie	Shepp	Pima County Department of Environmental Quality
Tracy	Sheppard	US EPA
Jada	Sherman	Solar United Neighbors
Amanda	Sherman	Air Force
Anika	Shethia	Houston Youth Climate Strike
Anna	Shipp	The Urban Institute
Gina	Shirey	Alaska Department of Environmental Conservation
Jacqueline	Shirley	NEJAC and RCAC
Bianca	Sievers	California Department of Water Resources
Abdulfetah	Sigal	EPA
Lauro	Silva	SV Partners for Environmental Justice
Brad	Sims	Exxon Mobil Corporation
Latorria	Sims	Adamantine Energy
Christopher	Smith	Interstate Natural Gas Association of America
Jennifer	Smith	American Academy of Arts and Sciences
Jonathan	Smith	Earthjustice
Megan	Smith	Shift7
Jacqueline	Smith	Attorney at Law
Dan	Solitz	Private Citizen
Healani	Sonoda-Pale	Ka Lahui Hawai'i
Sinduri	Soundararajan	CEQ
Yolonda	Spinks	MCAP
Anthony	Spyropoulos	EPA/OECA/OSRE
Shiv	Srivastava	Fenceline Watch
Gianna	St.Julien	Tulane University Law School
Riley	Stadt	Forest Service
Joanna	Stancil	USDA-FS
Erin	Stanforth	Mecklenburg County
Brenda	Staudenmaier	Clean Water Action Council
Stephanie	Stoltzfus	GSA-OCR

First	Last	Organization
James	Strange	DOE
Edward	Strickler	Private Citizen
Chris	Strobl	US Forest Service
Gulan	Sun	Motiva Enterprises
Katy	Super	Environmental Justice Health Alliance
Feleena	Sutton	Aera Energy
Serena	Sweet	BLM
Krti	Tallam	Stanford
Kerene	Tayloe	DOE
Sharifa	Taylor	Communities for a Better Environment (CBE)
Amy	Teague	USGS
Andrea	Thi	DOJ
Tami	Thomas-Burton	EPA
Eleanor	Thompson	Deloitte
Scott	Thorsgard	Allweather Wood
Cara	Thuringer	The Chisholm Legacy Project
James	Tillman	CGI
Nick	Tobenkin	Quanta Services
Kathy	Triantafillou	EPA
Renata	Trisilawati	Colorado Department of Public Health and Environment
Tammie	Tucker	AECOM
Oriana	Turley	Providence
Mila	Turner	Slipstream Inc.
Crystal	Upperman	Deloitte
Venus	Uttchin	HHS
Kavita	Vaidyanathan	U.S. Department of Energy
JV	Valladolid	ICC
Karina	Vangani	Arch Street Communications
Gloria	Vaughn	EPA
Kathleen	Vello	US EPA
Jessica	Verdinez	NAES Corporation
Cynthia	Vitale	Colorado Attorney General's Office
Katie	Vogle	EPA
Kathy	Wagner	Citizens With No Voice
Mary	Walker	Gulf Coast Ecosystem Restoration Council
Carla	Walker	World Resources Institute
Wendy	Wallace	Wendy
Stephen	Walls	NRDC
Stacey	Washington	SC Energy Office
Melissa	Watkinson	Puget Sound Partnership
Cheryl	Watson	Equitable Resilience & Sustainability
Rachel	Welch	Private Citizen
Arnold	Wendroff	Mercury Poisoning Project
Eric	Werwa	Department of the Interior

First	Last	Organization
DK	Wesley	Buncombe County Government
Paula	West	individual
Annisa	White	Entergy
Chris	Whitehead	ESI
Wesley	Wiggins	U.S. EPA
Rebecca	Williams	Vermont DEC
Patricia	Williams	PWilli Productions
Tanya	Williams	TO-Engineers
Tracy	Williams	Quiet American Skies Program
Kindle	Williams	Stanford University
Chenille	Williams	SC Energy Office
Dana	Williamson	USEPA
Victoria	Wilson	Naturally Urban Environmental Inc.
Daphne	Wilson	EPA Region 4
Ryan	Winkle	RAIL CDC
Jahi	Wise	WHO
Andrew	Wishnia	USDOT
Annie	Wolf	Solar United Neighbors
Leah	Wood	Washington State Department of Health
Kristin	Wood	DOT
Louise	Wright	wright4georgia
Macrina	Xavier	Air Force
Yasmin	Yacoby	U.S. Department of Energy
Scott	Yager	INGAA
Harrilene	Yazzie	BIA Alaska Region
Matthew	Young	BeechWood Inc.
Travis	Young	DOE
Rachel	Zander	Department of Natural Resources
Ariela	Zycherman	NOAA

Appendix D Presentation Slides



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Reminders:

-  **Meeting attendees are in listen/view mode only**
-  **Attendees who pre-registered for public comment will be given access to speak as time allows**
-  **The chat feature will not be available in this virtual meeting**
-  **If you do not get a chance to speak during the allotted time, please submit your comments in writing**

Written comments can be submitted until August 18, 2022, to whejac@epa.gov



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Welcome, Introductions & Opening Remarks



Victoria Robinson, Designated Federal Officer
U.S. Environmental Protection Agency



Richard Moore, White House Environmental Justice Advisory
Council Co-Chair – Los Jardines Institute

Peggy Shepard, White House Environmental Justice Advisory
Council Co-Chair – WE ACT for Environmental Justice

Catherine Coleman Flowers, White House Environmental
Justice Advisory Council Vice Chair – Center for Rural Enterprise
and Environmental Justice

Carletta Tilousi, White House Environmental Justice Advisory
Council Vice Chair – Havasupai Tribe



3

WHEJAC Members from the West



Angelo Logan
East Yard Communities for Environmental Justice

Rachel Morello-Frosch, PhD
Professor
UC Berkeley

Viola Waghiyi
Environmental Health and Justice Program
Director,
Alaska Community Action on Toxics

Miya Yoshitani
Senior Strategist
Asian Pacific Environmental Network



4

WHEJAC Members from the Midwest



Kim Havey

Director, Division of Sustainability
City of Minneapolis

Kyle Whyte, PhD

George Willis Pack Professor
Environment and Sustainability
University of Michigan

Hli Xyooj

Founder
Advancement of Hmong Americans



5

WHEJAC Members from the Southeast



Tom Cormons

Executive Director
Appalachian Voices

LaTricea Adams

Founder, CEO & President
Black Millennials for Flint

Harold Mitchell

Founder
ReGenesis

Beverly Wright, PhD

Founder and Executive Director
Deep South Center for Environmental Justice



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WHEJAC Members from the Southwest



Susana Almanza

Director, People Organized in Defense
of Earth and Her Resources

Jade Begay

Climate Justice Campaign Director
NDN Collective

Robert Bullard, PhD

Professor, Department of Urban Planning
and Environmental Policy
Texas Southern University

Juan Parras

Founder and Executive Director
Texas Environmental Justice Advocacy
Services



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WHEJAC Members from the Northeast



Maria Belen-Power

Associate Executive Director
GreenRoots

Jerome Foster II

Co-Founder & Co-Executive Director
Waic Up

Nicky Sheats, PhD

Director, Center for the Urban Environment
John S. Watson Institute for Urban Policy
and Research, Kean University

Maria López-Núñez

Deputy Director, Organizing and Advocacy
Ironbound Community Corporation

Michele Roberts

Co-Coordinator
Environmental Justice and Health Alliance for
Chemical Policy Reform



8

WHEJAC Member from Puerto Rico



Ruth Santiago
Attorney, Comité Dialogo
Ambiental and El Puente
Latino Climate Action Network



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Opening Remarks



Dr. Jalonne L. White-Newsome
Council on Environmental Quality (CEQ)
Senior Director for Environmental Justice

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Brief Updates & Timing for CEQ Policy Priorities

Policy Priority	Update
The Justice40 Initiative	<ul style="list-style-type: none"> Public release of agencies Justice40 covered programs (ongoing) Identification of covered programs' benefits and review of benefits methodologies (ongoing)
The Environmental Justice Scorecard	<ul style="list-style-type: none"> Request for Information (public today in the Federal Register) Additional updates through summer 2022, including on the White House Environmental Justice Interagency Council (IAC)
The Climate and Economic Justice Screening Tool (CEJST)	<ul style="list-style-type: none"> Working toward releasing Version 1.0 of the tool with guidance in late summer/early fall Moving forward, the tool will be updated and refined based on feedback and as new datasets and research become available
Update to Executive Order 12898	<ul style="list-style-type: none"> Work ongoing
White House Environmental Justice Interagency Council (IAC)	<ul style="list-style-type: none"> Working to empower and strengthen the IAC (ongoing)



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Carbon Management and Justice40



Shalanda Baker
 Director of the Office of Economic Impact and Diversity and Secretarial Advisor on Equity



Noah Deich
 Deputy Assistant Secretary
 Office of Carbon Management



Holly Buck
 Management and Program Analyst
 Office of Carbon Management



Jennifer Wilcox
 Principal Deputy Assistant Secretary
 Office of Fossil Energy and Carbon Management

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Justice40 Covered Programs

August 3, 2022

 U.S. DEPARTMENT OF **ENERGY**

OFFICE OF **ECONOMIC IMPACT AND DIVERSITY**

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What is Justice40? E.O. 14008, s. 223

Executive Order 14008:
Tackling the Climate
Crisis at Home and
Abroad
(1/27/21)

“How certain Federal investments might be made **toward a goal that 40 percent of the overall benefits** flow to disadvantaged communities.”

Source: <https://www.federalregister.gov/documents/2021/02/01/2021-02177/tackling-the-climate-crisis-at-home-and-abroad>

 U.S. DEPARTMENT OF **ENERGY**

OFFICE OF **ECONOMIC IMPACT AND DIVERSITY**

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Friday, July 22nd J40 Covered Programs Rollout

- 140+ Covered Programs, listed on the [Justice40 Website](#)
- [General Guidance](#) on Justice40
 - Disadvantaged Communities Tools & Resources
 - Tips on identifying & calculating benefits
 - Case Studies of similar efforts targeting benefits to disadvantaged communities
 - Approaches to J40 Implementation for formula and competitive funding
 - Stakeholder engagement guidance
- [Secretarial Letter](#) to Stakeholders: Reiterates Department's commitment to Justice40
- [Environmental Justice Explainer](#)
- [Justice40 Fact Sheet](#)
- Coming soon – Justice40 Covered Program Highlights
- Coming soon – Justice40 Community Relevant List



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Reminder of criteria for J40 “Covered”

Covered Program

A Federal Government program that makes **investments** in one or more of the following seven areas:

- ✓ Climate change
- ✓ Clean energy and energy efficiency
- ✓ Clean transportation
- ✓ Affordable and sustainable housing
- ✓ Training and workforce development
- ✓ Remediation and reduction of legacy pollution
- ✓ Critical clean water and waste infrastructure

Federal Investments

- ✓ Federal **grants and procurements** (including discretionary budget authority, direct/mandatory, and formula funding)
- ✓ **Financing** (including credit, loans, and guarantees)
- ✓ Programmatic Federal **staffing** costs (e.g. federal pay for staff that provide technical assistance)
- ✓ **Direct** financial benefits (including provision of goods and services); and
- ✓ Additional federal investments under covered programs as **determined by OMB**.



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Find Your Program!

Department of Energy's 140+ Justice40 covered programs list is organized by office. A program name that begins with BIL, is a new program created by the Bipartisan Infrastructure Law. Please click on an office to learn more about the Justice40 covered programs in that office.

ADVANCED RESEARCH PROJECTS AGENCY - ENERGY (ARPA-E) 

BONNEVILLE POWER ADMINISTRATION (BPA) 

FEDERAL ENERGY MANAGEMENT PROGRAM (FEMP) 

GRID DEPLOYMENT OFFICE (GDO) 

LOAN PROGRAMS OFFICE (LPO) 

OFFICE OF CLEAN ENERGY DEMONSTRATIONS (OCED) 



More information on the DAC indicators and the methodology can be found on the [Office of Economic Impact and Diversity's Justice40 Initiative page](#) or by scanning this QR code. You can also find your community in the [Department of Energy's Disadvantaged Communities Reporter](#).



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EJ Explainer

THE TRANSFORMATIVE POTENTIAL OF THE JUSTICE40 INITIATIVE

The Justice40 Initiative provides an opportunity for communities with environmental justice concerns to reap long-overdue development benefits; participate in the decision-making processes that directly impact them; and participate in the clean energy economy through workforce development programs and contracting opportunities. The agency is committed to working closely with DOE stakeholders to realize the transformative potential of Justice40.

To ensure an **equitable** transition to clean energy, and to avoid further harm to communities with environmental justice concerns, DOE is laser-focused on ensuring that every project that receives funding through a DOE Justice40 Covered Program adheres to the principles of **environmental justice**.



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J40 Fact Sheet

HOW DO WE MEASURE AND TRACK BENEFITS?

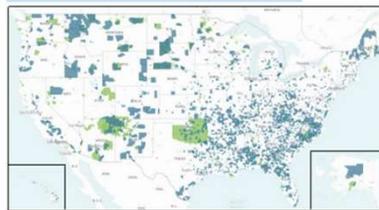
DOE has set eight **policy priorities** that define the types of energy-related outcomes J40 could deliver to disadvantaged communities (see right). Under J40, DOE Program Offices will establish metrics, measure, and report on the applicable benefits (or disbenefits) that their respective programs can have in a community related to these priorities. Below are examples of benefit metrics.

POLICY PRIORITY	EXAMPLE BENEFIT	EXAMPLE METRIC
Decrease energy burden	Reduction in energy costs due to technology adoption	Annual energy expenditures in DACs before and after program intervention
Decrease environmental exposure and burdens	Reduction in local pollutant emissions	Measurement of local pollutant in DACs before and after program intervention
Increase clean energy access	Increase access to clean energy serving DACs	Percentage of local electricity generation mix from clean energy that serves DACs

WHERE ARE THE DISADVANTAGED COMMUNITIES?

A **community** can be either people in **geographic proximity** or people experiencing a **common condition**. **Disadvantage** was measured based on a score across 36 indicators, such as energy burden, housing burden, park access, power outages, cancer incidence, and more. The higher the score, the more disadvantage. Census tracts with at least 30% low income households and disadvantage scores higher than 80 percent of those in their state are considered a disadvantaged community (DAC). DACs are shown in blue and green on the map below, with all territories and tribal lands in green.

DOE DEFINED DISADVANTAGED COMMUNITIES



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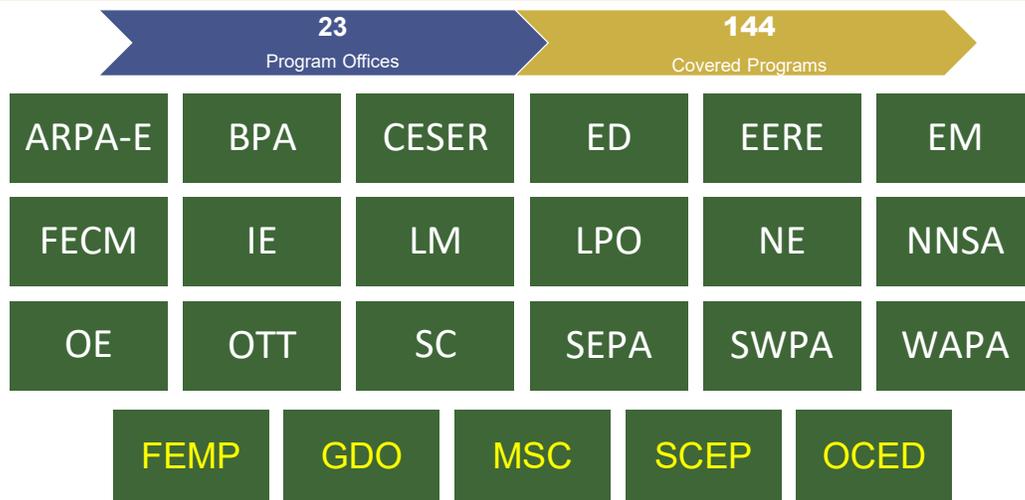
DOE Offices with J40 Covered Programs (Dec 2021)



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DOE Offices with J40 Covered Programs 2.0 (July 2022)



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J40 (July 2022) Across Federal Family

[Justice40 Initiative | The White House](#)

Agency	Abb.	J40 Covered Programs
Department of Energy (DOE)	DOE	144
Department of Agriculture	USDA	65
Health and Human Services	HHS	13
Homeland Security	DHS	4
Department of Housing and Urban Development	HUD	24
Department of Interior	DOI	65
Department of Veteran's Affairs	VA	1
Environmental Protection Agency	EPA	73

DOE leading in J40 Programs with a commitment to delivering benefits in:

- ✓ Climate change
- ✓ Clean energy and energy efficiency
- ✓ Clean transportation
- ✓ Affordable and sustainable housing
- ✓ Training and workforce development
- ✓ Remediation and reduction of legacy pollution
- ✓ Critical clean water and waste infrastructure

[Justice40-Covered-Programs-List_v1.1_07-15-2022.pdf \(whitehouse.gov\)](#)
expect this list to evolve over time as new Federal programs are created or existing programs sunset



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J40 Covered Programs Public Webinar

- Wednesday, August 17, 2022
- 2:00–3:30pm (EST)
- Agenda
 - **Welcome**
 - Secretary Granholm Remarks
 - Director Baker Remarks
 - **J40 Overview**
 - Deputy Director Reames
 - **J40 & BIL**
 - S3 Rep Remarks
 - **Highlight J40 Programs**
 - WAP
 - Clean Cities
 - NCSP
 - Geothermal Communities
 - Office of Science RENEW
 - **Moderated Q & A**
- Register [HERE](#), and please distribute!



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“Justice will serve as our North Star”

I am honored to lead this Department through a historic re-investment in our country’s energy infrastructure. Justice will serve as our North Star as we fight climate change and bring economic prosperity to our great Nation. I hope you will join us in our efforts to ensure that the benefits of BIL, DOE climate and clean energy programs, and other Federal efforts build a better future for *all* Americans.

Sincerely,

Jennifer M. Granholm



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Backup slides



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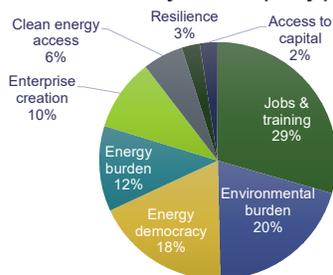
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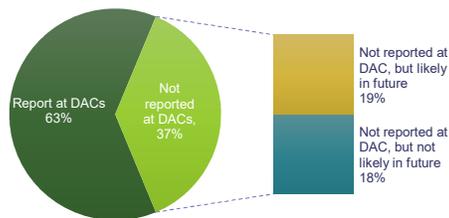
DOE's J40 Covered Programs OMB Submission Summary (December 2021)



Benefit metrics by DOE J40 policy priority



DACs assignment of benefit metrics



44 / 63
(~70%)
Covered Programs
had at least
1 benefit with $\geq 40\%$
accrued to DACs



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Friday, July 22nd J40 Covered Programs Rollout

What's in the July 22 Rollout?

- Publish Justice40 Covered Programs List (WH and DOE website)
 - with program descriptions on DOE website (staff working)
- S-1 Justice40 Letter to Stakeholders (in revision)
 - Reiterates Department's commitment to Justice40
- General Guidance for Justice40 Implementation (in revision)
 - Disadvantaged Communities Tools & Resources
 - Tips on identifying & calculating benefits
 - Case Studies of similar efforts targeting benefits to disadvantaged communities
 - Approaches to J40 Implementation for formula and competitive funding
 - Stakeholder engagement guidance
- Justice40 relevant program highlights (staff working)
- Press release +DOECAST + Media + Web (DOE/WH) + Social Media

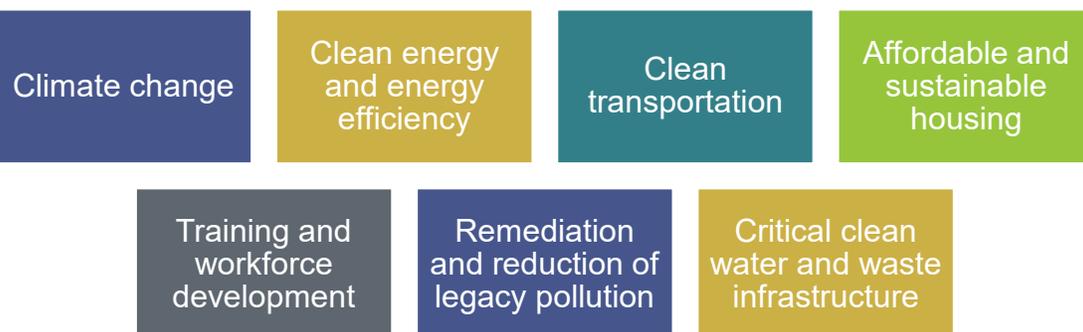


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Justice40 Covered Categories

Any Federal Government program that makes investments in one or more of the following seven areas:



Source: Interim Implementation Guidance for the Justice40 Initiative. <https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf>



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What Investments Does Justice40 Cover?

Any Federal investment in one or more of the following categories:

- **Federal grant and procurement spending** (including discretionary budget authority, direct/mandatory spending, and formula funding);
- **Financing** (including credit, loans, and guarantees);
- **Programmatic Federal staffing costs** (e.g., federal pay for staff that provide technical assistance)
- **Direct financial benefits** (including provision of goods and services); and
- *Additional federal investments under covered programs as determined by OMB.*

Source: Interim Implementation Guidance for the Justice40 Initiative. <https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf>



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Justice40 Policy Priorities

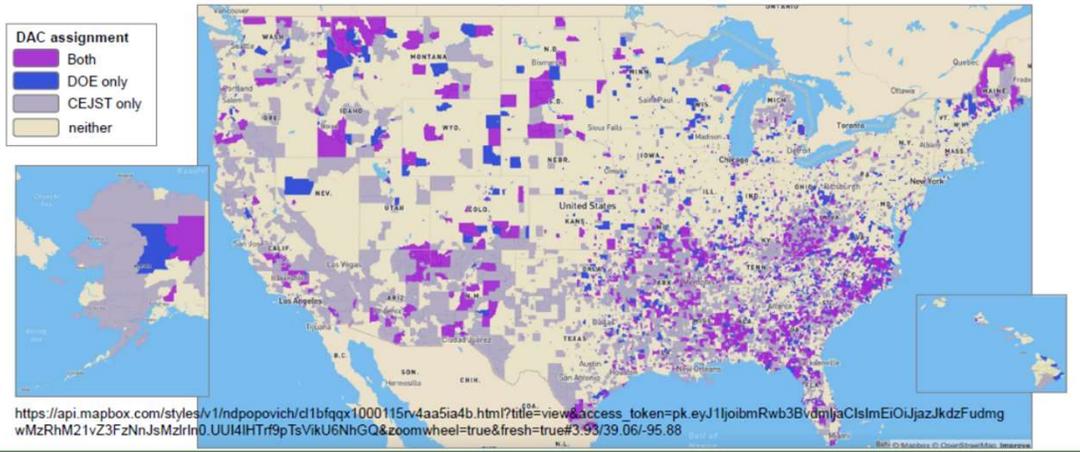
- 
- 
1. **Decrease** energy burden in disadvantaged communities (DACs).
 2. **Decrease** environmental exposure and burdens for DACs
 3. **Increase** parity in clean energy technology (e.g., solar, storage) access and adoption in DACs.
 4. **Increase** access to low-cost capital in DACs.
 5. **Increase** clean energy enterprise creation and contracting (MBE/DBE) in DACs.
 6. **Increase** clean energy jobs, job pipeline, and job training for individuals from DACs.
 7. **Increase** energy resiliency in DACs.
 8. **Increase** energy democracy in DACs.



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Comparing DOE DACs and CEJST



70+ % agreement in nearly every state (except AK 68%, MS 64%, WV 67%)



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Environmental Justice and J40 Implementation in Carbon Management

August 3, 2022

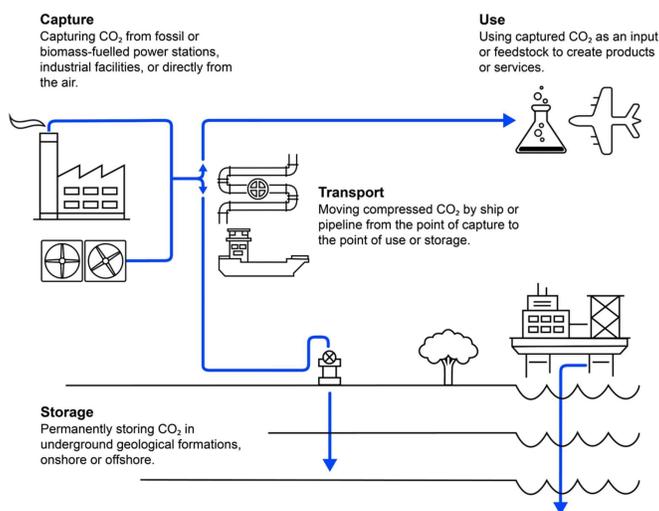
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Today's presentation

1. What the Bipartisan Infrastructure Law funds
2. What we have already heard from WHEJAC and environmental justice advocates
3. How the new requirements attached to our funding begin to address what we've heard

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Carbon Management overview



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Bipartisan Infrastructure Law Funding for Carbon Management

>\$12B over five years

- Power and industrial carbon capture projects
- New direct air capture hubs and innovation prizes
- CO2 transport, storage, and conversion studies, grants, and loan guarantees
- H2 production using fossil energy with carbon capture and storage



Expected development

- At least 6 carbon capture projects (12 operational today at commercial scale) and several new small-scale pilots
- At least 4 direct air capture hubs and several new small-scale pilots
- 100+ new dedicated CO2 storage wells
- Studies and financing for several new CO2 pipelines and transportation networks (~10,000 miles moving 10Ms tons CO2/yr)
- Several new CO2 conversion small-scale pilots



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Biden Administration funding principles

1



Opportunity to *demonstrate* **technoeconomics and social impacts**

2



...for:

1. *difficult-to-abate industrial sources*
2. *last-mile of net-zero power generation*
3. *carbon removal for legacy emissions...*

3



...in a *bipartisan and just way.*



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Questions people often have about CCS

Basic safety

- Are there risks to transporting CO2 in a liquified state; is it dangerous in any way?
- Would it impact the wildlife use of preserved areas?
- What are the failsafe mechanisms in place?
- Is it going to seep up, and how secure are these wells going to be?

Air and water

- Will it contaminate our drinking water?
- Does DAC include removal of co-pollutants?
- Is CCS going to worsen air pollution?

Liability

- Is there any potential liability for landowners that are going to be impacted? What kind of liability?
- What's it look like 50 years from now when we've got the projects and they're failing, or something is going on? Who fixes that and is responsible?



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Questions people often have about CCS

Knowledge base

How well thought out or well researched is the concept?
What are the alternative scenarios and have they been modeled?

Climate change

Are these plants and pipelines being designed to withstand extreme weather / sea level rise?

Wider policy questions

Are these projects going to delay mitigation of emissions? Are these projects economically feasible? What is the opportunity cost vs. spending the money on renewables?



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Request for Information summary (Jan. 2022)

Project Impacts

- Impacts must be assessed for the entire lifecycle & specifically for disadvantaged communities
- Impacts noted: health and safety concerns; fossil fuel entrenchment; land, water, & energy impacts; job creation; economic benefits; pollution reduction and remediation
- Respondents suggested DOE:
 - Require evaluation of cumulative impacts in funding applications
 - Prioritize projects with Community Benefits Agreements (CBAs)
 - Establish monitoring, permitting, and remediation requirements

How have you considered the impacts (e.g. environmental, health, economic, etc.) of your product/process? How do you measure these and do the needed tools exist?

Engagement

- Prioritize engagement with disadvantaged communities and labor throughout all stages of the project
- Engagement must be meaningful; early and frequent; transparent, inclusive, and accessible
- Respondents suggested DOE:
 - Require detailed engagement plans in funding applications
 - Allow engagement activities as an eligible use of funds
 - Create community project oversight boards

How well do you know the groups impacted by your work? What is the relationship with these communities and how do you communicate with them? Are there more opportunities for partnerships with community organizations?



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WHEJAC recommendations – May 2021

“To maximize investment benefits delivered to EJ communities, federal agencies must provide clear EJ criteria and guidance for grant applicants and centralized oversight.

....

Federal agencies must also make EJ and stakeholder engagement a requirement to receive program grants and other financial support.

All Agencies ... should score projects based on their ability to meet these and other EJ criteria.”



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Summary: What we know from experience

- People are concerned about using communities as dumping grounds for more waste, especially if these communities have existing pollution burdens
- People want local say in projects and strict protections for land and water
- Trust is lowest for developers
- More broadly in society — big questions about whether CCS for the power sector keeps existing plants running; does it deter phaseout of fossil fuels
- The concerns are about much more than the particulars — requires an approach that informs about particulars and considers structural power relations and procedural justice



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Funding Opportunity Announcements (FOAs)

- FECM recently released two non-BIL/BIL-adjacent FOAs which included scored SCI requirements:
 - DE-FOA-0002610: Carbon Storage Assurance Facility Enterprise (CarbonSAFE) Phase II - Storage Complex Feasibility
 - DE-FOA-0002614: Carbon Management
- 2610 and 2614 were an initial cut at SCI FOA integration
- Ongoing work to incorporate SCI elements into all additional BIL Carbon Management FOAs



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Our new requirements

– e.g. in recently released **CarbonSafe Phase II** funding opportunity

- Societal Considerations and Impacts Plans
 - Requirements for applicants and awardees
 - DEIA Plan
 - Justice40 Initiative Plan
 - Community and Stakeholder Engagement Plan
 - Quality Jobs
- Merit review criteria
 - Outlines how these plans will be scored in the selection process
- Guidance documents
 - Provides guidance to applicants on these topics, including process, content and FAQs and other resources



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Our requirements make some progress on these **WHEJAC** recommendations

- Community accountability in development and implementation
 - Specific funds dedicated to community engagement processes
 - Community awareness of grants and funding opportunities that are available, through materials in local languages and through accessible materials
 - Making EJ and stakeholder engagement a requirement to receive financial support
- Engagement Plan**

- Maximize economic, environmental, and public health benefits to community
 - Reduce / remove exposure to environmental hazards
 - Metrics and reporting on impacts and benefits that flow to local communities
 - Ensuring siting of infrastructure doesn't have a negative impact on local communities
- J40 Plan**

- Workforce development and training for underserved workers
 - Addressing institutional racism
- DEIA Plan**



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Big-picture questions we are grappling with as we develop these requirements

How do we achieve not just distributive and procedural justice, but also make progress on restorative and recognition justice?

How do we move from affirmations of importance and quantitative assessment to action?

45

Moving towards implementation



Vision: We affirm we care about justice / engagement / DEIA

Assessment: We mapped or assessed underserved communities / stakeholders / DEIA

Goals: From our assessment, we know X is lacking, so we want to improve in X

Outcomes: We know we have succeeded when Y (specific target) is reached

Implementation: To achieve Y, [specific actor] has to do Z [in specific timeframe]

Many of our teams risk getting stuck here because the analysis / mapping tasks fit with their existing toolkits and expertise

Our guidance and FOA structure helps build capacity to work on these parts

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Capacity-building for project teams

- Guidance documents for project teams include advice on:
 - Process: Steps for creating a plan and advice on how to go about it
 - Content: A walk-through of required elements, with details about what they might look like
 - Frequently asked questions and resources

Justice40 Initiative Plans

Purpose: Drives reporting to quantifiable, measurable, and tractable metrics on where benefits and negative impacts flow *and* drives project to minimize harms and maximize benefits to disadvantaged communities.

Energy & Environmental Justice Assessment

1. An assessment of impacted communities
2. An assessment of project benefits and where they flow
3. An assessment of project disbenefits / harms, and any other impacts not included under “benefits”
4. An assessment of information gaps

J40 Implementation Strategy

5. Background
6. Milestones and Timelines
7. Assessment of risks to realizing benefits and minimizing negative impacts
8. Resource Summary – staff, capabilities, budget

Community and Stakeholder Engagement Plans

Purpose: Ensure decision-makers and project teams seek out and facilitate the meaningful involvement of those potentially affected.

Outline:

1. **Background**
2. **Social characterization assessment** — understanding community dynamics, power relations, history
3. **Stakeholder analysis** — mapping who specifically will be engaged
4. **Engagement Methods and Timeline**
5. **Two-way engagement Statement** — how project incorporates principles of consent-based siting, pathway for changing project site based on societal considerations
6. **Project Agreements Statement** — description of any plans to negotiate a Community Benefits Agreement, good neighbor agreement, or similar agreement
7. **Engagement Evaluation Strategy** — how project teams will know if this is meeting community needs
8. **Resource summary**



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DEIA plans

Purpose: Drives project to fostering a welcoming and inclusive environment, supporting people from groups underrepresented in STEM and/or applicable workforces, advancing equity.

Key Elements:

1. **Background.** Prior and ongoing efforts by members of the project team relevant to DEIA, based on findings from an initial assessment
2. **Milestones and Timelines.** Targeted DEIA outcomes and implementation strategies, including milestones, and schedule
3. **Resource Summary.** Project resources dedicated to implementing the plan - including staff, facilities, capabilities, and budget



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Scoring these plans: What we look for

Quality Submission

- Quality (is it thorough, are there measurable actions)
- Support from impacted communities (are they partners, do they affirm support)
- Team and Resources (are they capable, is this adequately resourced)

Consequential Effort

- Integration into the project (is SCI integrated or treated as siloed)
- Influence (is the project designed so SCI can influence the direction of the project)
- Above and Beyond (does SCI go beyond regulatory requirements)

Applies Experience

- Previous efforts/lessons learned (does the project build on prior learning)

Quality Jobs

- Job creation or retention and workforce development, including workforce opportunities for underrepresented groups and members of disadvantaged communities



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Intervention points

At Application

- Meet requirements
- Score well at merit review

During award

- Refine plan within 90 days of award with DOE collaboration
- Conduct plan work
- One SMART milestone a year in Project Management Plan (plus individual Plan milestones)
- Public presentation on SCI work (SCI Peer Review)

At project conclusion

Final public report to include Plan, accomplishments and reporting



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Questions?

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Discussion Time

30:00

Start Stop Reset mins: 30 secs: 0 type:

None

Breaktime for PowerPoint by Flow Simulation Ltd. Pin controls when stopped

For the benefit of interpreters,
please speak clearly and slowly

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Public Comment Period

 Attendees who pre-registered for public comment will be given access to speak as time allows	 Each commenter has three (3) minutes to speak	 For the benefit of interpreters, please speak clearly and slowly
 If you do not get a chance to speak during the allotted time, please submit your comments in writing	 Written comments can be submitted until August 18, 2022, to whejac@epa.gov	 Comments will help the WHEJAC form better recommendations to CEQ/IAC

For the benefit of interpreters, please speak clearly and slowly

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03:00

For the benefit of interpreters, please speak clearly and slowly

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Closing Remarks

- **Richard Moore**, White House Environmental Justice Advisory Council Co-Chair – Los Jardines Institute
- **Peggy Shepard**, White House Environmental Justice Advisory Council Co-Chair – WE ACT for Environmental Justice
- **Catherine Coleman Flowers**, White House Environmental Justice Advisory Council Vice Chair – Center for Rural Enterprise and Environmental Justice
- **Carletta Tilousi**, White House Environmental Justice Advisory Council Vice Chair – Havasupai Tribe
- **Amanda Aguirre**, Senior Advisor to the Chair - Council on Environmental Quality
- **Victoria Robinson**, Designated Federal Officer -U.S. Environmental Protection Agency

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Reminder:

Written comments can be submitted through August 18, 2022, in three different ways:

- **by using the webform at** <https://www.epa.gov/environmentaljustice/forms/white-house-environmental-justice-advisory-council-whejac-public-comment>,
- **by creating comments in the Docket ID No. EPA-HQ-OA-2022-0050** at <http://www.regulations.gov>, and
- **by sending comments via email to** whejac@epa.gov.

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Reminders:

-  **Meeting attendees are in listen/view mode only**
-  **Attendees who pre-registered for public comment will be given access to speak as time allows**
-  **The chat feature will not be available in this virtual meeting**
-  **If you do not get a chance to speak during the allotted time, please submit your comments in writing**

Written comments can be submitted until August 18, 2022, to whejac@epa.gov



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Welcome, Introductions & Opening Remarks



Victoria Robinson, Designated Federal Officer
U.S. Environmental Protection Agency



Richard Moore, White House Environmental Justice Advisory
Council Co-Chair – Los Jardines Institute

Peggy Shepard, White House Environmental Justice Advisory
Council Co-Chair – WE ACT for Environmental Justice

Catherine Coleman Flowers, White House Environmental
Justice Advisory Council Vice Chair – Center for Rural Enterprise
and Environmental Justice

Carletta Tilousi, White House Environmental Justice Advisory
Council Vice Chair – Havasupai Tribe



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WHEJAC Members from the West



Angelo Logan
East Yard Communities for
Environmental Justice

Rachel Morello-Frosch, PhD
Professor
UC Berkeley

Viola Waghiyi
Environmental Health and Justice Program
Director
Alaska Community Action on Toxics

Miya Yoshitani
Senior Strategist
Asian Pacific Environmental Network



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WHEJAC Members from the Midwest



Kim Havey

Director, Division of Sustainability
City of Minneapolis

Kyle Whyte, PhD

George Willis Pack Professor
Environment and Sustainability
University of Michigan

Hli Xyooj

Founder
Advancement of Hmong Americans



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WHEJAC Members from the Southeast



Tom Cormons

Executive Director
Appalachian Voices

LaTricea Adams

Founder, CEO & President
Black Millennials for Flint

Harold Mitchell

Founder
ReGenesis

Beverly Wright, PhD

Founder and Executive Director
Deep South Center for Environmental Justice



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WHEJAC Members from the Southwest



Susana Almanza

Director
People Organized in Defense of Earth and
Her Resources

Jade Begay

Climate Justice Campaign Director
NDN Collective

Robert Bullard, PhD

Professor, Department of Urban Planning
and Environmental Policy
Texas Southern University

Juan Parras

Founder and Executive Director
Texas Environmental Justice Advocacy
Services



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WHEJAC Members from the Northeast



Maria Belen-Power

Associate Executive Director
GreenRoots

Jerome Foster II

Co-Founder & Co-Executive Director
Waic Up

Nicky Sheats, PhD

Director, Center for the Urban Environment
John S. Watson Institute for Urban Policy
and Research, Kean University

Maria López-Núñez

Deputy Director, Organizing and Advocacy
Ironbound Community Corporation

Michele Roberts

Co-Coordinator
Environmental Justice and Health Alliance for
Chemical Policy Reform



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WHEJAC Member from Puerto Rico



Ruth Santiago
Attorney, Comité Dialogo
Ambiental and El Puente
Latino Climate Action Network



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Opening Remarks



Brenda Mallory, Chair
The Council on Environmental Quality

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Discussion Time

30:00

Start Stop Reset mins: 30 secs: 0 type:

None

Breaktime for PowerPoint by Flow Simulation Ltd. Pin controls when stopped

For the benefit of interpreters,
please speak clearly and slowly

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J40 WG Proposed Recommendations: Overview and Deliberations

- Peggy Shepard, J40 WG Co-Chair
- Beverly Wright, J40 WG Co-Chair

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General Principles

Basic premise for these Justice40 *Implementation* Recommendations: The success of Justice40 utterly depends upon implementation that is as transformative in practice as Justice40 is in theory.

Transformative implementation practices to ensure that resources and benefits reach the communities that need them the most must be:

- thoughtfully developed by federal agencies
- deeply coordinated within and between agencies
- highly prioritized by federal agencies
- strongly incentivized within federal agencies, and for state, local, and private entities that receive Justice40 funding

The consequences are serious: Without transformative implementation, benefits will continue to flow to places already advantaged in terms of capacity, infrastructure, and connections.

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General Principles *(continued)*

Our first set of recommendations submitted in May 2021 explicitly addressed the need to end, not extend, federal support for fossil fuel infrastructure. Nevertheless, President Biden has recently asked the CEOs of fossil fuel companies to increase production and has opened public land to further fossil fuel investments in technologies that extend the dominance of fossil fuels are contrary to the intention of Executive Order 14008 because they will increase rather than curb climate pollution.

Therefore, we explicitly reiterate in these recommendations, our strong opposition to the investment of federal resources to promote fossil fuel infrastructure. Further, when the WHEJAC submitted its recommendations last year, we made it clear that J40 benefits and investments should not cause or increase harm to the communities J40 is meant to help. For example:

- We stated that non-biological carbon capture, use, and storage and hydrogen should not be considered benefits to disadvantaged communities. If, against the WHEJAC's recommendations, agencies consider such investments in their calculation of benefits to communities, they perpetuate the marginalization of the voices of those who have borne the greatest burden of pollution and use disadvantaged communities as testing grounds for unproven technologies.

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Transformative Practices

Goal: Transform the practices of federal agencies to ensure that Justice40 investments rectify—rather than reinforce or amplify—existing inequities.

1. Each agency should convene a J40 Advisory Board of environmental and climate justice advocates whose mission is to recommend and review J40 implementation and agency metrics for the ongoing improvement of the agency scorecard.
2. Each agency should require state and local recipients of J40 funds to use the Climate and Environmental Justice Screening Tool (CEJST) to identify disadvantaged communities.
3. Because access to monies is a benefit to localities, communities, and minority- and women-owned businesses, agencies should assess their progress toward meeting the 40-percent goal by calculating the amount of J40 dollars that flow to disadvantaged communities.
4. To keep money in the community and build community wealth, highly prioritize the support of locally owned businesses employing local people.
5. Ensure that jobs created by states or subcontractors with J40 monies pay fair wages and offer good benefits, safe working conditions, and other worker protections.
6. Each agency should optimize its staffing to ensure effective implementation of J40 activities.
7. In accordance with the principle of doing no harm, no federal agency should use any J40 funds to support fossil fuel infrastructure or generation

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Public Engagement

Goal: Ensure that public engagement is integral to each agency's Justice40 implementation process, not an add-on or an afterthoughts. Communities and stakeholders should provide on-the-ground knowledge that improves the design, implementation, and evaluation of Justice40 programs and investments.

8. Ensure that its public engagement and communication personnel are experienced professionals with community engagement expertise.
9. Develop a responsive and flexible community engagement plan that is reviewed by its J40 Advisory Board (see recommendation 1, above).
10. Align its work to address the priorities of disadvantaged communities and invest in projects that emerge from broad community participation.
11. Ensure all public-facing print and digital materials are translated or interpreted to cover all languages spoken in an impacted community, as defined by clear metrics.

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Public Engagement *(continued)*

12. Require that events and presentations as are accessible to individuals who are Deaf or hard of hearing or have visual or mobility disabilities, such as providing ASL interpretation services and ensuring that meeting locations are wheelchair accessible.
13. Require that food, childcare, transportation, interpretation services, and other incentives are provided to increase attendance in disadvantaged communities.
14. Public engagement performance must be prominently incorporated into agency, department, and individual evaluation metrics.
15. Fund local environmental and community-based organizations to increase their capacity to participate in local decision making and to hold government officials accountable.
16. Fund state agencies to add or expand outreach to disadvantaged communities by adding a J40 Community Program Manager position responsible for direct outreach to target communities.
17. Facilitate collaboration across state agencies and among states to help them share best practices for reaching and supporting disadvantaged communities.

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Public Outreach Best Practices

- Allow sufficient budgets for outreach and community engagement.
- Develop a robust outreach database that captures key demographics of engaged communities, such as racial, ethnic, socioeconomic, and linguistic data.
- Provide at least 1 month's notice of any public meeting, input opportunity, grant workshop, or Request for Information, and provide at least 3 months' notice of any grant application opportunity.
- Notices of events, requests for information, funding opportunities, and other information should be made available online and in print. Disseminate all information through community leaders, social media, newspapers, and through federal and state agencies that provide services to communities and businesses.
- Offer public events such as information sessions, grant workshops, or public input sessions at multiple times during normal work hours, evenings, and weekends.
- Hold public meetings and workshops both virtually and in-person to accommodate persons who are unable to travel as well as those without internet access.
- Ensure materials are accessible, easy to understand, and well designed, and that digital materials are Section 508 conformant.
- Public engagement expectations must be actionable and trackable in terms of process, outputs, and outcomes; meetings should be documented.
- Provide childcare and refreshments.
- Record public meetings and post them online.

78

Grants and Funding *(continued)*

Goal: Close the opportunity gap between well-resourced communities and disadvantaged communities and increase their capacity to apply for and administer grants.

18. Establish regional federal grant assistance hubs in the most disadvantaged communities to provide direct assistance with applying for grants and other opportunities.
19. Provide targeted outreach to diversify the pool of grant applicants and give those who are not usually a part of the process a fair chance to apply for funding.
20. Prioritize outreach to disadvantaged communities that have not received resources in recent years.
21. Create one centralized online location that facilitates access to J40 funding opportunities, such as the hub developed by the Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization.
22. Provide grants for capacity building and planning in communities, such as for staffing.

79

Grants and Funding *(continued)*

23. Create funding streams that meet the specific needs of the Gulf South, Native communities, and U.S. territories.
24. Allow for climate investments in public health, education, immigration, and other areas with clear climate impacts, in addition to the seven issue areas named in Executive Order 14008.
25. Establish procedures for widely disseminating information about funding opportunities to disadvantaged communities. Because many rural and low-income residents do not have internet access, it is not sufficient to post this information only online.
26. Support the competitiveness of small communities and community-based organizations
27. Following a successful grant application, support small communities and community-based organizations
28. Diversify economic opportunity by requiring that all grants paid out under the J40 initiative are directed to local minority-owned businesses to the fullest extent possible.

80

Proposed Infrastructure Projects

Goal: Reverse the legacy of infrastructure projects disrupting community life in frontline communities and ensure that frontline communities get the investment in infrastructure that sustains and improves community life.

29. Ensure federal government-funded infrastructure projects increase social resilience by supporting social infrastructure projects, such as schools and childcare.
30. Prioritize the funding of projects that incorporate fair labor standards and union jobs and support worker-owned companies, cooperatives, community-based organizations, and minority- and women-owned business enterprises.
31. Provide workforce development programs and trainings related to climate change free-of-charge, and compensate participants for expenses associated with transportation, childcare, and lost wages.
32. Provide the public with plain language information on renewable energy infrastructure projects to ensure that the transition from fossil fuels does not continue to overburden disadvantaged communities.

81

Accountability and Incentive Structure

Goal: Ensure that robust and effective *incentive structures* are put in place to create accountability and the successful implementation of Justice40 so that it addresses, and does not perpetuate, historic inequities.

To promote accountability within federal agencies, each agency should:

33. Incorporate J40 strategies and tactics into its strategic plans and continually monitor and evaluate implementation.
34. Develop and disseminate an annual report on its J40 implementation, environmental justice activities, and community engagement plans, including budgets, benefits, and impact.
35. Incorporate relevant J40 implementation metrics into individual performance evaluations at all agency levels.
36. Respond to questions and comments regarding J40 implementation made by the public during public meetings.

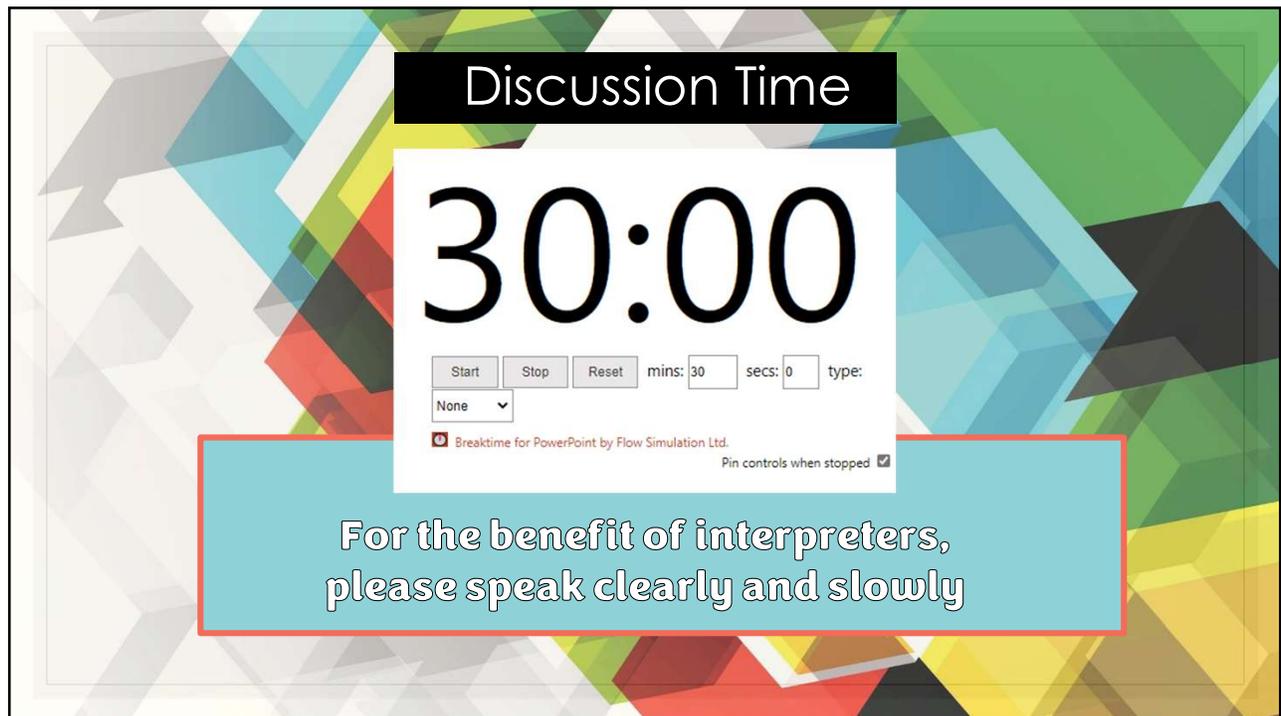
82

Accountability and Incentive Structure (continued)

To incentivize states and other implementation partners to ensure benefits are accruing to disadvantaged communities, federal agencies should:

37. Release J40 funds through staggered disbursements that are contingent upon completion of work stages or milestones to ensure that money granted to states and localities is implemented in accordance with both the spirit and the letter of J40.
38. Disburse limited duration grants, creating an opportunity to evaluate performance before regranting and to inform future grant decisions.
39. Ensure that states, localities, or contractors and recipients of J40 and other federal funds comply with Title VI of Civil Rights Act.
40. Develop a remedy or penalty for states or agencies that do not implement or comply with the intent of J40 investments to benefit disadvantaged communities.

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Discussion Time

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85

CEJST Proposed Recommendations: Overview and Deliberations

- Catherine Coleman-Flowers, CEJST WG Chair
- Rachel Morello-Frosch, CEJST WG member
- Nicky Sheats, CEJST WG member

86

Proposed CEJST Recommendations:

1. Integrate indicators of structural racism
 - Redlining
 - Racial Segregation
 - Racialized disparities of extreme wealth and deprivation
 - Mortgage foreclosures
2. Include relevant indicators of Native American and tribal land.
 - Consultation with Tribal Nations, tribal agency staff and community organizations
 - WHEJAC Indigenous Peoples and Tribal Nations Working Group
 - Include state recognized tribal lands, Hawaiian homelands, and traditional hunting and fishing treaty areas.
3. Provide more flexibility with respect to meeting the low-income threshold.
4. Enhance the climate change vulnerability category.
 - Heat island risk (green space/impervious surfaces)
 - Sea-level rise and flooding threats, particularly to hazardous sites
5. Integrate metrics of physical and social infrastructure.
 - Food security
 - Affordable housing
 - Housing quality
 - Transportation access
 - Banking services
 - Broadband access

87

Proposed CEJST Recommendations *(continued)*:

6. Enhance metrics of relevance to community health status
 - Perinatal outcomes (e.g. preterm birth, low birth weight)
 - Maternal health outcomes (e.g., severe maternal morbidity and mortality)
7. Expand or enhance environmental hazard indicators
 - National Air Toxics Assessment (aka AirToxScreen) or the Risk-Screening Environmental Indicators (RSEI) Model
 - Concentrated animal feeding operations (CAFO)
 - Oil and gas extraction activities
 - Mining sites from the Abandoned Mine Land Inventory System, as well as data on formerly used defense sites
8. Integrate measures of sensitive populations and receptors
 - Schools
 - Prisons
9. Add indicators of drinking water quality and sanitation
 - Drinking water quality (public systems and domestic well communities)
 - Access to and quality of sewage and sanitation services (huge data gap)
10. Provide a cumulative impact metric
 - Scale up and/or adapt validated state methods (e.g., CalEnviroScreen)
11. Provide a more transparent and accessible interface for timely user and community feedback
 - Community/user identified data gaps and errors
 - Ground truthing
 - Improve language access for non-English Speakers

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Discussion Time

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**Incinerator Proposed Recommendations:
Overview and Deliberations**

- Nicky Sheats, WHEJAC member
- Maria López-Núñez, WHEJAC member

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Findings and Recommendation

Findings

- Incineration is particularly problematic from an environmental justice perspective because 79 percent of large municipal waste incinerators in the United States, including many of the dirtiest and highest emitting facilities, are located in environmental justice communities.
- Most of today's incinerators were built in the 1980s, with only one constructed after 1995. They have therefore exceeded their -30-year useful lives- yet continue to operate with outdated technology and insufficient pollution control devices.
- Congress ordered EPA to fix the problem of incinerator pollution by the early 1990s, but 30 years later, environmental justice communities are still waiting for these needed protections. The cost of delay in revising municipal waste incineration emissions standards that would presumably lower dangerous emissions can be measured in illness and death in environmental justice and other communities.
- Communities are not even requesting that new protective laws be created, only that EPA's regulations meet the standards Congress required.

Recommendation

- **We urge EPA to revise incinerator air pollution emissions limits as quickly as possible and move forward as if lives were at stake, because they are.**

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92

WHEJAC Business Meeting Reflections & Conversation

The WHEJAC will use this time to provide additional workgroup updates; discuss action items; and finalize next steps.

- Updates from Other Workgroups
- Action Items
- Next Steps

93

E.O. 12898 Revisions Workgroup

Workgroup Members:

Richard Moore, WG Chair – *Los Jardines Institute*

Susana Almanza -- *People Organized in Defense of Earth and Her Resources (PODER)*

Angelo Logan – *East Yard Communities for Environmental Justice*

Juan Parras – *Texas Environmental Justice Advisory Services (T.E.J.A.S.)*

Carletta Tilousi – *Havasupai Tribe*

Kyle Whyte – *University of Michigan*

Hli Xyooj -- *Advancement of Hmong Americans*

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EJ Scorecard Workgroup

Workgroup Members:

Kyle Whyte, WG Co-Chair – *University of Michigan*

Peggy Shepard, WG Co-Chair – *WEACT for Environmental Justice*

Robert Bullard, *Texas Southern University*

Maria Lopez-Nunez– *Ironbound Community Corporation*

Richard Moore – *Los Jardines Institute*

Rachel Morello-Frosch – *University of California, Berkeley*

Michele Roberts – *Environmental Justice and Health Alliance for Chemical Policy Reform*

Beverly Wright – *Deep South Center for Environmental Justice*

95

Indigenous Peoples & Tribal Nations Workgroup

Workgroup Members:

Carletta Tilousi, WG Co-Chair – *Havasupai Tribe*

Kyle Whyte, WG Co-Chair – *University of Michigan*

Susana Almanza – *People Organized in Defense of Earth and Her Resources (PODER)*

Jade Begay – *NDN Collective*

Viola Waghiy – *Alaska Community Action on Toxics*

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Climate Resilience Workgroup

Workgroup Members:

Maria Lopez-Nunez, WG Co-Chair – Ironbound Community Corporation

Miya Yoshitani, WG Co-Chair – Asian Pacific Environmental Network

Jade Begay – NDN Collective

Catherine Coleman-Flowers – Center for Rural Enterprise and Environmental Justice

Angelo Logan – East Yard Communities for Environmental Justice

Richard Moore – Los Jardines Institute

Rachel Morello-Frosch – University of California, Berkeley

Juan Parras – Texas Environmental Justice Advisory Services (T.E.J.A.S.)

Michele Roberts – Environmental Justice and Health Alliance for Chemical Policy Reform

Nicky Sheats – Kean University

Hli Xyooj – Advancement of Hmong Americans

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Discussion Time

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Closing Remarks

- **Peggy Shepard**, White House Environmental Justice Advisory Council Co-Chair – WE ACT for Environmental Justice
- **Richard Moore**, White House Environmental Justice Advisory Council Co-Chair – Los Jardines Institute
- **Catherine Coleman Flowers**, White House Environmental Justice Advisory Council Vice Chair – Center for Rural Enterprise and Environmental Justice
- **Carletta Tilousi**, White House Environmental Justice Advisory Council Vice Chair – Havasupai Tribal Council
- **Amanda Aguirre**, Senior Advisor to the Chair - Council on Environmental Quality
- **Victoria Robinson**, Designated Federal Officer - U.S. Environmental Protection Agency



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Reminder:

Written comments can be submitted through August 18, 2022, in three different ways:

- **by using the webform at** <https://www.epa.gov/environmentaljustice/forms/white-house-environmental-justice-advisory-council-whejac-public-comment> ,
- **by creating comments in the Docket ID No. EPA-HQ-OA-2022-0050** at <http://www.regulations.gov>, and
- **by sending comments via email** to whejac@epa.gov.

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Appendix E Written Comments
Written Public Comment From August WHEJAC 2022 Public Meeting

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Full Name (First and Last): Aimee Diaz

Name of Organization or Community: Hartford Coalition for Safe Technology

City and State: Corona, CA

Brief description about the concern: Dear Members of the White House Environmental Justice Advisory Council, Hartford, CT is an Environmental Justice community that is home to a number of regional waste facilities, including a medical waste plant, a sewage treatment facility and a recycling facility. We have been impacted for years by a landfill and trash incinerator. We breathe in smog created by highway and city traffic. Thus, the residents of Hartford already carry an undue environmental burden for the region. The 5G antennas so near our homes add to this burden. Yet, hundreds of 5G antennas have been placed in Hartford neighborhoods, exposing our families and children to radio frequency radiation that can very well impact our health. These antennas have been placed in our neighborhoods without input from the residents. Objections to their placement have been made to the state Public Utilities Regulatory Authority (PURA) without success. The telecommunications companies must notify property owners before installing a small cell antenna, but the tenants who are the actual residents are not required to be notified. It appears that neither the telecoms, nor the state, nor the city has taken responsibility to monitor the antennas to ensure that they are working properly and that emissions are within allowable limits.

What do you want the WHEJAC to advise the White House Council on Environmental Quality to do?:

We ask that you advocate for this and the updating of FCC safety standards for radio frequency emissions. They have not been updated since the 1990s and need to reflect more recent scientific findings on the health and environmental impacts of these emissions. We believe the focus should be on investing in fiber optic infrastructure and utilize existing fiber optic infrastructure and put a halt to 5G antennas until we know more about the health and environmental impacts. Please consider the following: Dr. Joel M. Moskowitz, in a Scientific American article entitled “We Have No Reason to Believe 5G Is Safe” states that there are hundreds of studies linking electromagnetic wave exposure to health issues such as cancer, neurological disorders, and reproductive harm. Over four hundred scientists and medical doctors have signed an international appeal calling for a delay in implementing 5G technology until we know more about the health impacts.

1. Senator Blumenthal has called for a delay in implementing 5G technology until more about the health impacts can be understood.
2. Theodora Scarato, Executive Director of Environmental Health Trust, has stated: “Insects, birds and airborne species are unprotected as regulations do not apply to wildlife. Trees, plants and bacteria are also impacted by RF, yet are ignored by human centric regulations.” And, with respect to EHT et al. v FCC, she added that “the FCC had ignored scientific evidence on environmental effects.”
3. There needs to be ongoing monitoring of the 5G antennas radiation, especially in Environmental Justice communities that are impacted with so many other environmental hazards.
4. EJ advisory committee to advocate for an updating of FCC safety standards for radio frequency emissions. They have not been updated since the 1990s and the standards need to take into more recent scientific findings of health and environmental impacts of these emissions.

5. To put a halt to 5G antennas until we know more about the health and environmental impacts and to invest in fiber optic infrastructure and utilize existing fiber optic infrastructure in the communities that already have it.

We ask that this be considered an environmental justice issue.

Sincerely,

Aimee Diaz
Hartford Coalition for Safe Technology

(1) (Environmental Health News(Jun 01, 2020)

Environmental Injustice

"Today, zip code is still the most potent predictor of an individual's health and well-being"

Gwen Ranniger

Environmental racism has plagued communities of color for decades.

Pollution, climate change, and more have stripped from these communities the right to their most basic needs: clean water, food, air, and safe housing.

Here's a look at how these issues spurred the environmental justice movement—and how much work still needs to be done.

The Father of Environmental Justice

Dr. Robert Bullard (Credit: University of Michigan)

Dr. Robert Bullard of Texas Southern University is known as the "father of environmental justice." A leading activist for the movement since it emerged in the 1980s, he's been at the forefront of the cause and ultimately defined the movement:

"Environmental justice embraces the principle that all people and communities have a right to equal protection and equal enforcement of environmental laws and regulations....Today, zip code is still the most potent predictor of an individual's health and well-being. Individuals who physically live on the "wrong side of the tracks" are subjected to elevated environmental health threats and more than their fair share of preventable diseases..Reducing environmental, health, economic and racial disparities is a major priority of the Environmental Justice Movement."

Air pollution:This 2018 study found that communities living below the poverty line have a 35 percent higher burden from particulate matter emissions than the overall population. Non-whites had a 28 percent higher health burden and African Americans, specifically, had a 54 percent higher burden than the overall population.

PITTSBURGH—If air pollution levels in all of Allegheny County were lowered to match the levels seen in its least-polluted neighborhoods, about 100 fewer residents would die of coronary heart disease every year, according to a new study.

A majority of the lives that would be saved by such an initiative are in the region's poor and minority communities—people who are also particularly susceptible to contracting and dying from COVID-19.

"Losing any lives to a preventable cause like pollution is tragic, and more deeply so when that human cost is borne unfairly along economic and racial lines," Joylette Portlock, executive director of Sustainable Pittsburgh, a Pittsburgh-based environmental and community advocacy nonprofit, told EHN.

The entire Pittsburgh region has problems with air pollution, but levels can vary widely between neighborhoods due to a variety of factors including industrial pollution sources, traffic patterns, and geography.The study, conducted by researchers. Journal Environmental Health in March, found that the region's most polluted census tracts are often in poor and minority neighborhoods, while the census

tracts with the cleanest air tend to be in wealthier and whiter neighborhoods. This results in a higher rate of air pollution-related deaths from coronary heart disease in poor and minority neighborhoods.

"Until you have actual numbers to hang your hat on, it's hard to understand the magnitude of this problem," Chemical waste: People of color make up nearly half the population in fence-line zones – areas closest to hazardous chemical facilities. They are almost twice as likely as whites to live near dangerous chemical plants. Chemical facilities in communities of color have almost twice the rate of incidents compared to those in predominately white neighborhoods – one incident per six facilities compared to one incident per 11 facilities.

In detail: In June 2012, EHN dispatched reporters to seven communities to report on their struggles to cope with an array of environmental threats. Years later their stories still resonate. communities still face disproportionate impacts from pollution.

Water contamination: Concerns about drinking water contamination among minority groups have been reported since the 1950s. Water quality is certainly still an issue today; for example, people of the Navajo Nation have dealt with water contamination since the 1950s uranium mining of the region, as well as the Gold King Mine wastewater spill in 2015. Today, one in three homes in the Navajo Nation do not have a tap or a toilet.

Water quality can be affected by a host of different toxic chemicals or metals. For example, lead leached from aging pipes can pollute the drinking water. Flint, Michigan, has been dealing with community lead poisoning since 2014. More than half of Flint's population is people of color. A few major cities across the country such as Detroit, Pittsburgh, Newark, Baltimore, and Pittsburgh struggle with select toxics in their tap water.

Climate change: The effects of climate change, such as extreme weather conditions, can have devastating impacts on low-income communities. Extreme weather can displace residents that lack a safe place to go or the capacity to rebuild, and even cause death, especially if housing is old or inadequately built.

Hurricane Katrina was devastating to New Orleans' African American community. Racial discrimination had pushed Black communities to the outskirts of the city; these were communities most impacted when the levees failed and are systematically neglected by local government. By 2013, about 80 percent of the mostly Black residents of the city's Lower 9th Ward had not returned to their community due to inadequate rebuilding efforts.

Environmental injustices contribute to disparities in health status among populations of different race, ethnicity, and socioeconomic status. Due to disproportionate exposure to contaminated air, water, toxic chemicals, unsafe workplaces, and other environmental hazards, poor, disenfranchised, and minority communities face more health problems. Children, due to their developing state and age

geographic Information Systems (GIS) have been used increasingly to map instances of environmental injustice, the disproportionate exposure of certain populations to environmental hazards.

Some of the technical and analytic difficulties of mapping environmental injustice are outlined in this article, along with suggestions for using GIS to better assess and predict environmental

health and equity. I examine 13 GIS-based environmental equity studies conducted within the past decade and use a study of noxious land use locations in the Bronx, New York, to illustrate and evaluate the differences in two common methods of determining exposure extent and the characteristics of proximate populations. Unresolved issues in mapping environmental equity and health include lack of comprehensive hazards databases; the inadequacy of current exposure indices; the need to develop realistic methodologies for determining the geographic extent of exposure and the characteristics of the affected populations; and the paucity and insufficiency of health assessment data. GIS have great potential to help us understand the spatial relationship between pollution and health. Refinements in exposure indices; the use of dispersion modeling and advanced proximity analysis; the application of neighborhood-scale analysis; and the consideration of other factors such as zoning and planning policies will enable more conclusive findings. The environmental equity studies reviewed in this article found a disproportionate environmental burden based on race and/or income. It is critical now to demonstrate correspondence between environmental burdens and adverse health impacts—to show the disproportionate effects of pollution rather than just the disproportionate distribution of pollution sources. Key words: environmental hazards, environmental health, environmental justice, exposure analysis, Geographic Information Systems, GIS, risk assessment, spatial analysis.

It is critical now to demonstrate correspondence between environmental burdens and adverse health impacts—to show the disproportionate effects of pollution rather than just the disproportionate distribution of pollution sources. Key words: environmental hazards, environmental health, environmental justice, exposure analysis, Geographic Information Systems, GIS, risk assessment, spatial analysis.

Environ Health Perspect 110(suppl 2):161–171 (2002)

1 JANUARY 2022

Environmental Justice Definition

Environmental justice refers to the equitable distribution of burdens and benefits in the use and exploitation of goods and natural resources that are of common interest, such as water and air. In legal terms, this concept ensures equity in resolving environmental conflicts and seeks the active participation of the people involved or affected by decisions made about the environment.

The use and exploitation of the elements of nature go through decisions that often produce conflicts or differences between interest groups. For example, it is necessary to decide how to distribute the available water in a territory among different social and environmental uses, such as human and animal consumption, the maintenance of ecosystems, and productive uses for agriculture, mining, industry, and others. Will water be prioritized for human consumption or production? How will ecosystems be protected? If the demand for the different uses exceeds the amount of water available, a conflict can arise regarding which uses to prioritize and satisfy. The decisions made will generate burdens on some groups, for example, communities without access to water for their crops and benefits for others. In cases like these, environmental justice will warn about the unequal distribution of burdens and benefits for the people affected in decisions on the use of natural assets and will demand the significant participation of all these affected people in decisions related to the environment. Environmental justice issues. In the United States, the Environmental Protection Agency (US EPA) is an agency independent of the federal government in charge of environmental protection matters. They define environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income concerning the development, implementation, and enforcement of environmental laws, regulations, and policies."

When they talk about meaningful involvement, they refer to people's opportunity to participate in decisions about activities that may affect their environment and/or health. The public's contribution can influence the regulatory agency's decision to consider community concerns in the decision-making process. Then, the decision-makers will seek out and facilitate the involvement of those potentially affected. When you think about the environment, your mind might conjure up images of rambling rivers, peaceful woodlands or scenic mountains. However, a broader definition of environment is the surroundings or conditions in which a person lives. By this definition, the environment would include your home, place of work, schools, and community parks. These are the places you spend your time, and they play a big role in your overall health, happiness and well-being.

When you think about the environment, your mind might conjure up images of rambling rivers, peaceful woodlands or scenic mountains. However, a broader definition of environment is the surroundings or conditions in which a person lives. By this definition, the environment would include your home, place of work, schools, and community parks. These are the places you spend your time, and they play a big role in your overall health, happiness and well-being.

Those involved in the movement called environmental justice feel that a healthy environment is a necessary component of a healthy life. In this lesson, we will learn about environmental justice and its efforts to make everyone's environment clean, safe and healthy.

Environmental Justice Background

To understand the origin of the environmental justice movement, one must go back to the United States in the 1980s. In this period, there were numerous local conflicts in which inhabitants, who often lived in poor areas and of ethnic minorities, protested the imposition of new waste dump facilities on their territory.

They suffered pollution due to discharges produced by polluting industrial activities installed in their municipalities. The protests were not led by environmentalist groups, while the issue was directly related to pollution or environmental risk. Instead, they were led by local citizens concerned about

developing the areas where the conflict was taking place. In the first phase, these protests were carried out in isolation, but it did not take long to have a national impact.

One of the main conflicts of the time was that of Warren, North Carolina, in 1982. The state government decided to locate a polychlorinated biphenyls (PCB) landfill in that province (a rural area with a low-income level and populated mainly by African-Americans). The decision encountered strong local opposition and sparked protests organized by movements that had the support of some regional and national civil rights groups and some politicians. The protests ended in acts of peaceful resistance: opponents of the project tried to block the access of the trucks that were supposed to transport the PCB, and the police did not hesitate to intervene and make mass arrests. The opposition groups considered that this government decision was considered environmental racism (the term was used for the first time). These protests had national repercussions, and more protests began in other places.

The United States Environmental Protection Agency defines environmental justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. In other words, your health should not suffer because of the environment where you live, work, play or learn.

The concept of environmental justice began as a movement in the 1980s due to the realization that a disproportionate number of polluting industries, power plants, and waste disposal areas were located near low-income or minority communities. The movement was set in place to ensure fair distribution of environmental burdens among all people regardless of their background.

Environmental Justice Issues and Examples

Examples of environmental burdens that may be considered under the umbrella of environmental justice cover many aspects of community life. These burdens can include any environmental pollutant, hazard or disadvantage that compromises the health of a community or its residents. For instance, one of the environmental justice issues and examples is inadequate access to healthy food. Certain communities, particularly lower-income or minority communities, often lack supermarkets or other sources of healthy and affordable foods.

Another issue is inadequate transportation. While public transportation may be available in urban areas, policies must be monitored to avoid cuts in service and fare hikes that make it difficult for community residents to pursue employment or an adequate living standard.

Air and water pollution are major environmental justice issues. Because many lower-income or minority communities are located near industrial plants or waste disposal sites, air and water quality can suffer if not properly monitored.

These communities may also contain older and unsafe homes. Older homes are more likely to have lead-based paint that can chip and find its way into the dust and soil surrounding the home, leading to illness. These houses may also be prone to structural problems, mold or other hazards that put residents at higher risk of health problems.

Principles of Environmental Justice

In 1991, principles of environmental justice were adopted at the First National People of Color Leadership Summit meeting in Washington D.C.

The role of environmental justice role is to enforce the application of the right to health and a healthy environment for citizens. It guarantees equal access to nature's resources and decisions about environmental issues.

What is the meaning of environmental justice?

USEPA defines environmental justice as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income concerning the development, implementation, and enforcement of environmental laws, regulations, and policies.

What is the importance of environmental justice?

Environmental justice is essential in the fight to improve and maintain a safe and healthy environment. It is especially for those who have traditionally lived, worked, and played in the areas closest to contaminants..

This are villages, and community of Who Eni./Naoc is operating system of global warming ENERGY and greenThe European based multinational Corporations can cause or be complicit in human rights abuses in third Countries. Victims of cooperation's to account in their own country Against this backdrop judicial, mechanisms have increasingly been replied on to bring legal proceedings in the home states of the corporations..This study attempts to map out all relevant cases (35 in total) filed in member states of the European union on the basis of Alleged Corporate human rights abuses in third Countries. It also provides an in depth analysis of 12 cases and identified various Obstacles (Legal procedural and practical) Faced by Claimants in accessing legal remedy. On the basis of these findings, It makes a number of recommendations to the EU institutions in order to improve access to Legal remedies in the EU for victims of human rights abuses by European based companies in third Countries..

This paper was required by the European Parliaments sub committee on Human rights and the English language manuscript was completed on 01 February 2019, and this paper will be published on the European Parliaments online date base "THINK TANK"

The reason is for the use of judicial mechanism to hold companies to account for human rights abuses in third Countries is receiving increased attraction.

Now am writing in team's of Access to remedies for Victims of corporate human rights abuses in third Countries by the European based multinational Corporations an a legal proceedings as an alleged corporate human rights abuses in third Countries and it was identified among the various Obstacles that we're mentioned among the 12 cases for legal procedural and practical) in accessing legal remedy on the basis of these findings for an recommendations to the EU institutions in order to improve access of legal remedies in EU for victims of human rights abuses by European based companies in third Countries.. "Reference" EX/EXPO/B/DROI/FWC/2013-08/LOt4/07 February 2019-PE603475 (C) EUROPEAN UNION, 2019..(CASE STUDY)

NOW REPORTING ON THE LEGAL REMEDIES FOR VICTIMS OF CORPORATE HUMAN RIGHTS ABUSES IN THIRD COUNTRIES 2010-2015-2022 (CASE STUDY TO ENI/NAOC "TO THE WORLD POWERS.

Addressing the issues of Environmental justice and injustice on the legal remedies for Victims of corporate human rights abuses in Africa, Nigeria, Rivers State in ogba egbema, Ndoni Local Government Area of Onelga, Omoku.. (OB/OB NATURAL CRUDE OIL & NATURAL GAS PROGRESSING & PRODUCTION PLANT) BEING THE LARGEST OIL & GAS RESOURCES ACTIVITIES IN THE HOLE OF AFRICA, BEING MANAGED BY A MULTI NATIONAL COMPANY BY NAME ENI/NAOC LIMITED)

Following the federal government progress on address current and historic environmental injustice that has included external civil rights, compliance and emphasis on Historic and Historical Overburdened and under served communities and now facing systemic barriers in accessing Benefits and opportunities through the federal government and undeserved communities to reduce green house gas emissions,.

Response by the white house council on environmental quality to the white house environmental justice Advisory Council,base on the recommendation Justice04, climate and Economic justice with the Executive order 12898 been submitted to the US congress pursuant to the federal government advisory committee (May 2020)

External civil rights, compliance and emphasis on Historic and Historical Overburdened and under served communities and now facing systemic barriers in accessing Benefits and opportunities through the federal government and undeserved communities to reduce green house gas emissions,.

Response by the white house council on environmental quality to the white house environmental justice Advisory Council,base on the recommendation justice40, climate and Economic justice with the Executive order 12898 been submitted to the US congress pursuant to the federal government advisory committee (May 2020)

And Now in the 19/07/2022 ENI/NAOC AND ITALIAN PROSECUTORS HAS DROPPED APPEAL ON NIGERIA CORRUPTION ACQUITTAL ..The Italian prosecutor dropped a legal challenge over the acquittal of Eni SPA and it's managers in a corruption case of related oil drilling rights in Nigeria, according to the Energy major..

" WHAT DO WE HAVE HAVE TO SAY,!!"EUROPEAN LEGAL RIGHT ABUSE " WHY SUPPORT ENI/NAOC

There is a serious fire break out now at the Ob/Ob gas plant..the rivers and steam's are seriously over flowing with crude oil, the pipe lines are linking with gasses all over the region, to the extent of destroying people's house goods floating out from there compounds .. Please am seriously calling on the world powers to come and see it for themselves let's save the world, and also for a joint inspections or Eni will take over the world using the Revolution systematic demonic strategy. We are seriously in a dangerous zoon do to Eni/Naoc Exploratory on Ob/Ob 44 the highest gas wall in the hole worldwide... Until we all vanish before the world will come for away rescue to this solutions affecting the world.... (Amadike Gabriyah)

The heatwave which has gripped Kent this week is set to come to an end with three days of thunderstorms. The Met Office has issued weather warnings for Monday (August 15), Tuesday (August 16) and Wednesday (August 17).

"Torrential downpours" are being forecast for much of the UK which may cause disruption including flash flooding. The Met Office yesterday put a yellow weather warning in place for Monday with other parts of the UK also set for thunderstorms on Tuesday.

Tuesday's weather has now been extended to the southeast of England, including Kent, with a further warning also in place on Wednesday. The warning will begin at 10am tomorrow morning and last until 11:59pm on Tuesday before a fresh warning comes into place on Wednesday at 10am and lasts until the



end of the day.











To: **WHEJAC** Public Comments for August 2022 Meeting

whejac@epa.gov

From: Arnold P. Wendroff, PhD, MPhil, MScEd, **Mercury Poisoning Project** (718) 499-8336 Key Words < **mercury Santeria** > < **Wendroff mercury** >

Dear WHEJAC,

This is the second of my emails to your august body, illustrating the individual and organizational/collective hypocrisy of EPA, CDC/ATSDR, and manifold other governmental and non-governmental agencies insofar as they have colluded to suppress these exposures and refused (not merely failed) to assess mercury vapor levels inside dwelling units in those Caribbean and Latino communities where elemental mercury is or has been sold by botanicas for magico-religious applications. These several agencies have also refused to make any *substantive* assessment of biomarker levels (urine mercury levels) of individuals living in these communities, as well as failing to substantively inform clinicians serving said communities.

The email below, sent on **May 13, 2011**, describes a putative index case, and I've attached two later journal papers along with my comments on them, that flesh out and define that index case.

As you can see from my attached letter of **May 5, 1997** from Congresswoman Velazquez, this issue has been put to Congressman Waxman, an alleged environmental advocate

Dear Representative Waxman:

I would like to bring to your attention a concern raised by a New York constituent. Dr. Arnold Wendroff, of the Mercury Poisoning Project, has sent me a packet of materials detailing a very hazardous threat to the health of many of my constituents: the long-term exposure to mercury in Latin American and Caribbean communities as a result of its domestic use for magico-religious and ethno-medical purposes.

As you can see from my attached letter of **August 8, 2000** from Congresswoman Velazquez, this issue has been put to the White House in **2000**, and Vice President Gore had referred it to Representative Velazquez.

Dear Dr. Wendroff:

I have received a copy of the July 25, 1999 that you sent to Vice President Gore. I am aware of the advocacy that you have been doing on behalf of victims of mercury poisoning in New York City for many years. I appreciate the work that you have done to bring this issue to light.

Then Representative Charles (AKA "Chuck") Schumer, wrote to me on **June 22, 1994**, stating that:

Your concerns about mercury metal used in household products are certainly valid and I agree with you that warning labels are a simple solution. As you outline in your letter, mercury metal is a highly toxic material that is especially dangerous for pregnant women and young children. It simply does not make sense that we regulate labelling of a multitude of dangerous household products and we do not have any regulation of this potentially hazardous material.

On **September 23, 1997**, Representative Schumer followed up with a letter to NYC's Commissioner of Health:

Dear Dr. Nojica,

I am writing to you today due to my concern over the suspected increase in the use of unlabeled mercury.

Through the diligent work of one of my constituents, Dr. Arnold P. Wendroff, many elected officials, including myself, have been made aware of the possibility of increased usage of unlabeled mercury by unaware New Yorkers. These anonymous vials are being sold for medicinal and religious purposes. The seriousness of this matter cannot be underscored enough.

As you know, exposure to mercury is an extreme health hazard. Studies have shown links between levels of mercury and birth defects, both neurological and physical, in children.

If Dr. Wendroff is correct, then many New York children are needlessly being put at risk. Therefore, I am suggesting that you do three things: ensure the proper labeling of mercury by either creating strict procedures or strongly enforcing current labeling standards, alert "at-risk" consumers to the dangers of mercury poisoning, and lastly, start a program which would test mercury exposure in children.

But again, no substantive attempt was made to "alert at-risk" consumers to the dangers of mercury poisoning", or to "start a program which would test mercury exposure in children."

Again, on **January 14, 1998**, Congressman Schumer wrote to the NYC DOH Commissioner,

To my dismay, I found that nearly identical language was used to allay an inquiry made to Mayor David Dinkins by Dr. Arnold Wendroff in 1993. I would be greatly disappointed if the Department of Health was using age-old data to respond to my recent inquiry. The health of New York's residents, especially those of our children, deserve constant vigilance, not laissez-faire attitudes.

His description of the DOH's "laissez-faire attitudes," as opposed to "constant vigilance," is equally, if not even more applicable to the EPA's and the EJ community's response to these ongoing domestic mercury vapor exposure, which has garnered a wealth of pious verbiage, but has abjectly failed to prevent occupants of many thousands of apartments from inhaling toxic (especially developmentally neurotoxic) levels of mercury vapor on a continual basis.

On **July 13, 2010**, the EPA Region 2 Administrator wrote to me

Dear Dr. Wendroff:

Thank you for your correspondence of May 27, 2010 regarding ritualistic mercury use. As always, we appreciate your continuous interest, concern and involvement to raise awareness on issues concerning the ritualistic use of mercury. As was stated in previous communications with you, the EPA has worked well with others to raise awareness on the issue and take action within the current legal framework of our authorities. We will continue to do so in the future. EPA has an ongoing concern about potential mercury (Hg) exposure associated with its use in ritualistic practices. Conceivably, such exposures can even extend to non-users through a scenario where ritualistic Hg practices by previous occupants of residential dwellings have contaminated the living space of the current unsuspecting residents. EPA Region 2 is exploring ways to characterize this potential exposure scenario.

She appended this **FY11 Regional Applied Research Effort Proposal**:

Science and Environmental Issues: Elemental mercury plays a role in several related Afro-Caribbean religions including Santeria (NJDEP, 2003). Such practices include the sprinkling of mercury in residential dwellings. Air monitoring data in the hallways of buildings in areas with a large Afro-Caribbean population in NJ have provided strong evidence that at least 2% of apartments in these areas have an ongoing or historic presence of mercury, consistent with such cultural use, that exceeds the background in non Afro-Caribbean areas (NJDEP, 2003; NJDEP, 2007). Such uses potentially pose a health hazard, not only to those who engage in these practices, but to subsequent occupants of these dwellings.

Research Objectives and Expected Outcomes: Despite knowledge of the existence of ritualistic practices involving mercury, no data exist on levels of in-dwelling exposure. A study conducted previously by NJDEP relied on indirect indicators outside apartments of conditions inside apartments and could not provide an estimate of the airborne concentration of mercury inside the apartments. **Measurement of mercury vapor inside a dwelling, at the point of exposure, is the best environmental indicator of potential hazard. This pilot level study of targeted housing will inform the potential extent and magnitude of mercury vapor contamination secondary to ritualistic practices by directly measuring mercury vapor concentration in targeted housing units.**

However, the proposal was never implemented, and the data that the ATSDR deemed “an urgent need” has never been collected, for the political reasons I have spelled out in detail in the documents I’ve submitted.

A unique exposure pathway that has received little research attention is the exposure to children from religious and ethnic uses in homes and cars or in remedies containing metallic mercury (ATSDR 1997; Johnson [in press]; Wendroff 1990, 1991). In some religious practices of Latin American or Caribbean origin, there are traditional rituals or remedies that involve mercury. These include intentional sprinkling of liquid elemental mercury on the floor, burning candles made with mercury, using mercury in baths, adding it to perfume, or wearing small containers of mercury around the neck for good luck. **There is an urgent need to obtain information on the levels of exposure from these practices to determine if children or adults are at risk.** Mercury vapor concentrations may be much higher after use during the winter months when the heat is turned on and the windows are closed, so data that reflect a variety of possible exposure scenarios are also needed. ATSDR Toxicological Profile for Mercury, March 1999, p. 480 (attached)

In closing, I would like to remind you of the considerable written (letterhead) correspondence I’ve received from the EPA, documenting the agency’s deep and longitudinal awareness of this environmental injustice, and its ongoing pretense that they/it has adequately addressed the issue, and that there are no ongoing domestic mercury vapor exposures due to magico-religious mercury use in Caribbean/Latino communities.

 AUER EPA OPPTS 03 07 94.pdf	3/11/2010 11:01 ...	WaveBrowser HT...	204 KB
 BARRACK EPA R2 01 21 98.pdf	3/11/2010 6:37 PM	WaveBrowser HT...	52 KB
 BATTAGLIA ORD FOIA 03 15 13.pdf	3/15/2013 10:25 ...	WaveBrowser HT...	405 KB
 BATTAGLIA ORD FOIA 11 02 12.pdf	11/2/2012 12:37 ...	WaveBrowser HT...	47 KB
 BATTAGLIA ORE FOIA 11 05 13.pdf	11/19/2013 2:15 ...	WaveBrowser HT...	352 KB
 BRUCE EPA FOIA 03 18 13.pdf	3/20/2013 3:28 PM	WaveBrowser HT...	304 KB
 BRUCE EPA Gen Counsel FOIL 07 17 12...	7/26/2012 10:23 ...	WaveBrowser HT...	18 KB
 CALANOG SAN JOSE Hg Report 02 10.pdf	9/28/2015 1:26 PM	WaveBrowser HT...	5,648 KB
 CALDERON EPA R2 FOIA 08 23 12.doc	8/23/2012 2:26 PM	Microsoft Word 9...	34 KB
 CALDERON EPA R2 FOIA RESPONSE 12 ...	12/13/2012 10:15...	Microsoft Word D...	16 KB
 CARRA EPA OPPTS 11 22 94.pdf	3/10/2010 9:38 PM	WaveBrowser HT...	134 KB
 CASPE EPA R2 07 10 00.pdf	3/8/2010 11:02 AM	WaveBrowser HT...	64 KB
 CASPE EPA R2 08 20 98.pdf	3/12/2010 8:59 AM	WaveBrowser HT...	103 KB
 CASPE EPA R2 11 16 98.pdf	3/12/2010 9:22 AM	WaveBrowser HT...	133 KB
 CESTONE FOIA LET 05 31 17.pdf	6/5/2017 3:24 PM	WaveBrowser HT...	369 KB
 COOK EPA OSWER 07 25 06.pdf	3/7/2010 5:26 PM	WaveBrowser HT...	43 KB
 DAVIES EPA 10 04 01.pdf	3/8/2010 10:44 AM	WaveBrowser HT...	53 KB
 DOA EPA LET 04 05 11.pdf	4/5/2011 4:17 PM	WaveBrowser HT...	407 KB
 ENCK EMAIL 12 06 11.docx	3/22/2012 7:31 PM	Microsoft Word D...	21 KB
 ENCK EPA 01 29 16.pdf	2/4/2016 8:42 PM	WaveBrowser HT...	56 KB
 ENCK EPA R2 07 13 10.pdf	7/17/2010 4:36 PM	WaveBrowser HT...	136 KB
 EPA EJ SMALL GRANTS 12 12 LAWRENCE...	12/8/2012 10:25 ...	WaveBrowser HT...	215 KB
 EPA R2 PR CEH BUDGET 2012-2013.pdf	5/9/2013 11:34 AM	WaveBrowser HT...	26 KB
 EPA R2 PR WORKPLAN 2012-2013 Cente...	5/9/2013 11:33 AM	Microsoft Word D...	24 KB
 ETZEL EPA LET 04 20 15 posted 04 28 15...	5/1/2015 10:08 PM	WaveBrowser HT...	141 KB
 ETZEL EPA LET ND posted 04 21 15.pdf	4/25/2015 6:09 PM	WaveBrowser HT...	126 KB
 GOLDMAN EPA 12 09 96.pdf	4/11/2011 9:49 PM	WaveBrowser HT...	148 KB
 GOLDMAN EPA OPPTS 09 08 94.pdf	3/10/2010 8:49 PM	WaveBrowser HT...	94 KB
 GOLDMAN EPA TO JOHNSON US SENAT...	3/11/2010 10:52 ...	WaveBrowser HT...	187 KB
 GOODE EPA OCR 05 04 99.pdf	3/9/2010 9:59 AM	WaveBrowser HT...	341 KB
 GOTTESMAN EPA - HQ FOIA Acknowled...	11/15/2011 7:19 ...	Microsoft Word 9...	33 KB
 GOTTESMAN EPA FOIA 04 30 13.docx	4/30/2013 10:22 ...	Microsoft Word D...	171 KB
 GOTTESMAN EPA FOIA 02 06 07.pdf	3/6/2010 6:12 PM	WaveBrowser HT...	32 KB
 HENRY EPA OPPT EMAIL 11 16 11.docx	11/16/2011 7:53 ...	Microsoft Word D...	15 KB
 HIGGINBOTHAM EPA OCR 11 06 01.pdf	3/8/2010 10:48 AM	WaveBrowser HT...	100 KB
 HORINKO EPA OSWER 07 19 02.pdf	3/7/2010 6:21 PM	WaveBrowser HT...	79 KB
 INSPECTOR GENERAL REPORT 08 31 06...	9/16/2011 2:07 PM	WaveBrowser HT...	230 KB
 KATZ EPA 07 17 97 Suzanne Wells office...	3/11/2010 3:31 PM	WaveBrowser HT...	444 KB
 KENNY EPA R2 APW EQAward 04 24 03...	3/12/2010 10:35 ...	WaveBrowser HT...	939 KB
 LOPEZ 01 23 18.pdf	1/26/2018 9:28 PM	WaveBrowser HT...	211 KB
 LUFTIG EPA OSWER to Weiner 03 16 00.p...	3/8/2010 2:58 PM	WaveBrowser HT...	70 KB
 MAPLES EPA + NYCDOH, HHC, PRFI pam...	3/9/2010 3:27 PM	WaveBrowser HT...	471 KB
 MATTHEWS EPA R2 LET 09 21 12.pdf	9/24/2012 5:13 PM	WaveBrowser HT...	193 KB
 McKECHNIE EPA OIG 09 12 06.pdf	3/7/2010 5:32 PM	WaveBrowser HT...	134 KB
 MILLER EPA 05 23 13.pdf	5/23/2013 5:19 PM	WaveBrowser HT...	581 KB
 MILLER EPA Off Gen Counsel 08 08 12.pdf	8/13/2012 4:05 PM	WaveBrowser HT...	128 KB
 MOLLICK EPA IG 07 06 12.pdf	7/12/2012 11:15 ...	WaveBrowser HT...	71 KB
 MOOS EPA OPPT 12 05 00.pdf	3/8/2010 11:51 AM	WaveBrowser HT...	37 KB
 MUGDAN & MEARS EPA R2 04 07 17.pdf	4/7/2017 4:36 PM	WaveBrowser HT...	30 KB
 MUGDAN EPA 02 14 17.pdf	2/22/2017 7:46 AM	WaveBrowser HT...	157 KB
 MUGDAN EPA R2 03 21 16.docx	3/21/2016 6:47 PM	Microsoft Word D...	14 KB
 MUGDAN EPA R2 07 16 03.pdf	3/12/2010 11:15 ...	WaveBrowser HT...	67 KB
 PAGE EPA 07 12 13.pdf	7/24/2013 9:44 AM	WaveBrowser HT...	189 KB
 PAGE EPA LET 06 29 12.pdf	7/6/2012 6:18 PM	WaveBrowser HT...	53 KB
 PAVLOU EPA R2 07 24 00.pdf	3/8/2010 11:09 AM	WaveBrowser HT...	92 KB
 PITRUZZELLO EPA R2 02 19 98.pdf	3/11/2010 10:10 ...	WaveBrowser HT...	59 KB
 RARE PROPOSAL 2010.pdf	3/28/2011 3:56 PM	WaveBrowser HT...	121 KB
 SANDERS EPA OPPTS 04 29 97.pdf	3/11/2010 2:42 PM	WaveBrowser HT...	87 KB
 SANDERS EPA ORD 08 25 11.pdf	8/29/2011 5:46 PM	WaveBrowser HT...	109 KB

 SANDERSON EPA R7 09 27 00.pdf	3/8/2010 12:15 PM	WaveBrowser HT...	100 KB
 SEBASTIAN EPA R2 05 23 03.pdf	3/12/2010 10:46 ...	WaveBrowser HT...	67 KB
 SIMON EPA R2 01 03 97.pdf	3/11/2010 11:03 ...	WaveBrowser HT...	55 KB
 SIMON EPA R2 01 23 97.pdf	3/11/2010 1:53 PM	WaveBrowser HT...	79 KB
 SMITH EPA R5 04 23 01.pdf	3/8/2010 9:58 AM	WaveBrowser HT...	55 KB
 STEELE EPA ORD 03 01 00.pdf	3/8/2010 2:50 PM	WaveBrowser HT...	29 KB
 STOLLER EPA R2 02 13 97.pdf	3/11/2010 2:10 PM	WaveBrowser HT...	136 KB
 TEJADA EPA 12 08 14.pdf	12/19/2014 4:23 ...	WaveBrowser HT...	227 KB
 WELLS EPA 03 20 00.pdf	3/8/2010 3:09 PM	WaveBrowser HT...	174 KB
 WELLS EPA OERR 02 03 03.pdf	3/12/2010 10:06 ...	WaveBrowser HT...	160 KB
 WELLS RUMTF MEMO 02 03 03.pdf	5/22/2010 10:49 ...	WaveBrowser HT...	158 KB
 WILKINS EPA NCEA 02 05 97.pdf	3/11/2010 2:03 PM	WaveBrowser HT...	179 KB
 ZACHOS EPA R2 03 29 07.pdf	3/6/2010 6:27 PM	WaveBrowser HT...	144 KB

That this is far from the reality of the situation is demonstrated by this final document, from the University of Puerto Rico's School of Public Health:

From: Carmen M Velez Vega [<mailto:carmen.velez2@upr.edu>]
Sent: Thursday, **April 06, 2017** 6:37 AM
To: Arnold P. Wendroff, PhD
Cc: aalsha@coe.neu.edu; icordero@uga.edu; helen.suh@tufts.edu; meekerj@umich.edu; p.brown@neu.edu; e.zimmerman@neu.edu; j.manjourides@neu.edu; vulpe@berkeley.edu; debjwat@umich.edu; peggy@weact.org; brendarivera@salud.gov.pr; schantz@illinois.edu; crece@northeastern.edu

Subject: Re: MERCURY EXPOSURE FROM ITS MAGICO-RELIGIOUS USES IN SOME CARIBBEAN & LATINO COMMUNITIES -- TWO POWER POINT PRESENTATIONS

Dear Arnold, Greetings from Puerto Rico.

Thank you for the information.

You are right, in Puerto Rico we see sales of elementary mercury for religious and spiritual rituals and are usually sold in "Botánicas" which are small, local stores that sell folk remedies, candles, incense and articles used in rituals.

It is usually not open, but instead you need to talk to the owners or their employees to get to these materials.

People that sell the EM know it is illegal, but the people that are believers and practice these rituals create a demand.

I believe from what I know from the communities I have worked with, that people in general are not aware of the harmful effects of EM, and that it is very difficult to clean. I am on the board of directors of a Federally Qualified Community Health Center, in the Santurce area of San Juan, where we have a great concentration of immigrants from the Dominican Republic and Haiti.

We learn of these practices within people that come from these Countries, as well as from native Puerto Ricans.

I believe it would be very important to study this potential health hazard in this geographical area. It is important to note this area also coincides with lower socio economic levels and housing challenges.

If you have any suggestions we would be very grateful.

Sincerely,

Carmen

Carmen Milagros Vélez Vega, PHD., MSW.

Catedrática

Programa Doctoral en Determinantes Sociales de la Salud

Co Investigadora Participación Comunitaria: PROTECT

dept. Ciencias Sociales
Escuela de Salud Pública
Recinto de Ciencias Médicas
Universidad de Puerto Rico

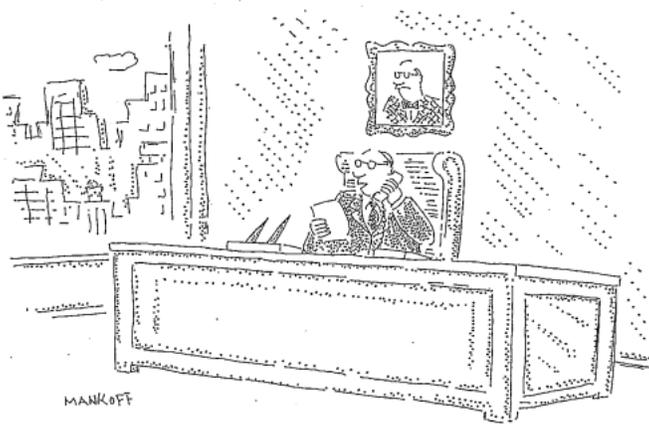
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The documentation I've presented in this email and its predecessor, is just a tiny fraction of my exhaustive collection on this intractable issue, intractable due to the EPA's nonfeasance, hypocrisy, and indifference, to employ but three mild epithets.

I look forward to testifying, for whatever good that will do.

Nil desperandum!

Arnold Wendroff



"And you can rest assured that your problem is being ignored at the very highest levels."

The New Yorker 08/21/06



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From: Arnold P. Wendroff, PhD mercurywendroff@mindspring.com
Sent: Friday, **May 13, 2011** 3:35 PM
To: nadine.gracia@hhs.gov
Cc: enck.judith@epa.gov; lge2@cdc.gov; patrice.simms@usdoj.gov; Therese.J.Fretwell@hud.gov;
'Arnold P. Wendroff, PhD' mercurywendroff@mindspring.com
Subject: NEED FOR INTERAGENCY ASSESSING & ADDRESSING MAGICO-RELIGIOUS MERCURY CONTAMINATION OF HOUSING AND MERCURY POISONING OF OCCUPANTS -- AN INDEX CASE !!

To: J. Nadine Gracia, MD, MSCE, Chief Medical Officer, **U.S. Department of Health & Human Services & Federal Interagency Environmental Justice Working Group** (202) 690-7694

cc: Judith Enck, Regional Administrator, **U.S. EPA R2 & Federal Interagency Environmental Justice Working Group** (212) 637-5000

cc: Leah Graziano, RS, Associate Regional Representative, **Agency for Toxic Substances & Disease Registry, R2 & Federal Interagency Environmental Justice Working Group** (732) 906-6932

cc: Patrice L. Simms, Esq, Deputy Assistant Attorney General, **Environmental & Natural Resources Division, U.S. Department of Justice & Federal Interagency Environmental Justice Working Group** (202) 514-0943

cc: Therese Fretwell, Regional Environmental Officer, Region II **U.S. Department of Housing & Urban Development & Federal Interagency Environmental Justice Working Group** (212) 542-7445

From: Arnold P. Wendroff, PhD, **Mercury Poisoning Project** (718) 499-8336 www.mercurypoisoningproject.org Key Words < **mercury Santeria** >

Dear Dr. Gracia,

It was a pleasure meeting you (and your colleagues) yesterday at the **Federal Interagency Environmental Justice Working Group** here in Brooklyn, and having the opportunity to bring the environmental health threat posed by the magico-religious and ethnomedical uses of elemental mercury in some Caribbean and Latino communities to your collective attention.

I described two cases of housing contamination that are virtually certain to be associated with these esoteric uses of mercury. I have attached an official report of the RI Department of Environmental Management. I have more details of this case, obtained by telephone interviews with the mother of the impacted family, the landlord of the contaminated apartment, the RI DEM official supervising the assessment and cleanup, two commercial environmental cleanup agents involved in the decontamination, and two officials of the RI DOH.

I have also spoken with the attending clinical toxicologist. However, I have yet to obtain the official report of the RI DOH.

This should be more than sufficient evidence to **induce the CDC to investigate this case**, and to **publish its details in the MMWR**. **This appears to be the long-awaited index case of magico-religious mercury contamination of a dwelling, and the poisoning of its occupants.**

Yesterday I presented you with a copy of my verbal testimony to the NEJAC, which stated in part:

Two recent (February 2011) yet to be published cases of mercury contamination of housing have been reported, one from magico-religious use, and the other associated with ethnomedical use. In the former case, a Puerto Rican family in RI with 3 children had been poisoned by residual mercury in carpeting, left by a former Dominican occupant who practiced unspecified "rituals" at the altar in her bedroom. The home was grossly contaminated (50 µg/m³) and had to be evacuated, a 3 year old child was acutely poisoned, and she, her mother and two siblings all had highly elevated urinary mercury levels of 80, 78, 49, 38 µg/L. All the children had to be chelated. In the second case in CT, a Mexican family had imported mercury for ethnomedical uses from Mexico, and it apparently escaped to contaminate their apartment to the extent that it had to be evacuated and decontaminated.

This case is very similar to that presented by von Muhlendahl in *The Lancet* in 1990 "Intoxication from mercury spilled on carpets" (attached).

Given the data presented in the (attached) ATSDR's Children's Exposure to Elemental Mercury: A National Review of Exposure Events, and comparing the import, especially the environmental justice import of these magico-religious mercury exposures to other sources of mercury exposure described in the attached articles in the MMWR, I again urge you to ensure that the CDC and ATSDR actively investigate this case, obtain all relevant medical and environmental records, and publish the case in the MMWR so as to inform the public health and clinical communities that magico-religious mercury use is not merely a "potential" health threat as Surgeon General Novello labeled it in her (attached) letter to me dated October 16, 1990, but is in fact a very real, albeit largely latent environmental health disaster, as suggested by Dr. Greenberg in *Emergency Medicine News* in 1999 (attached).

A fuller version of this RI case, and a review of similar less certain cases of ethnomedical and ritualistic mercury exposure should be published in the NIEHS's *Environmental Health Perspectives*, which to date has published three papers and one letter on allied issues (Wendroff 1997; Riley et al. 2001; Prasad 2004; Garetano et al 2006).

HHS should be conferring with the EPA and with FEMA (attached letters from Garratt & Paulison of FEMA) on how to address the need to assess and decontaminate large numbers of homes found to be contaminated with actionable levels of mercury vapor. In particular, federal specifications need to be set for portable mercury vapor filters, which could be emplaced when a home is found to be contaminated and there is no immediate means to de-contaminate it.

It will be impossible for decontamination efforts to keep pace with the identification of contaminated housing, once the public becomes aware of the magnitude and widespread nature of magico-religious mercury use and attendant contamination. Availability of portable mercury vapor filters is the only way that families living in contaminated housing can remain in that housing without having to be evacuated and the home decontaminated. HUD also has a major interest in protecting its tenants from wholly preventable exposure to residual mercury in flooring, in particular its Office of Healthy Homes and Lead Hazard Control. HUD housing with heavily Caribbean and Latino occupancy are ideal sites for researching mercury vapor levels, beginning in public hallways as detailed in attached letter and accompanying research protocol from Judith Enck of EPA R2.

Government is concerned over chemical warfare agents being loosed on the unsuspecting public to the extent that all New York City Transit Police officers are outfitted with gas masks. Yet there appears to be no such concern over the many thousands of Caribbean and Latino men, women, children, and fetuses who are currently inhaling developmentally neurotoxic levels of mercury vapor in their homes at second hand. See the attached paper by Carpi & Chen (ES&T 2001) for data on the extreme persistence and problematic nature of far smaller domestic mercury spills.

I will send you one or two additional emails detailing the failure of a variety of HHS organizations to substantively address this issue in a manner that is protective of the public, as opposed to being protective of politicians and bureaucrats.

I look forward to your response.

Sincerely yours,

Arnold Wendroff

Exposures of Children

A unique exposure pathway that has received little research attention is the exposure to children from religious and ethnic uses [of mercury] in homes and cars or in remedies containing metallic mercury (ATSDR 1997); Johnson [in press [May 1999]]; Wendroff 1990, 1991). In some religious practices of Latin American or Caribbean origin, there are traditional rituals or remedies that involve mercury. They include intentional sprinkling of mercury on the floor, burning candles with mercury, using mercury in baths, adding it to perfume, or wearing small containers of mercury around the neck for good luck. **There is an urgent need**

to obtain information on the levels of exposure from these practices to determine if children or adults are at risk. Mercury vapor levels may be much higher ... during the winter months when the heat is turned on and the windows are closed, so data that reflect a variety of possible exposure scenarios are also needed.

ATSDR March 1999 TOXICOLOGICAL PROFILE FOR MERCURY pp. 480-481

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From: Arnold P. Wendroff, PhD [<mailto:mercurywendroff@mindspring.com>]
Sent: Wednesday, **March 02, 2011** 10:40 AM
To: robert.vanderslice@health.ri.gov
Cc: 'Arnold P. Wendroff, PhD'
Subject: REQUEST FOR INFORMATION RELATING TO MERCURY POISONING CASE IN CUMBERLAND RI

To: Robert R. Vanderslice, PhD, Chief, Office of Environmental Risk Assessment, Rhode Island Department of Health (401) 222-5960 www.health.ri.gov

From: Arnold Wendroff, PhD, Mercury Poisoning Project (718) 499-8336 www.mercurypoisoningproject.org Key Words < mercury Santeria >

Dear Dr. Vanderslice,

I was referred to you by your colleague Ann Marie Beardsworth, in reference to my enquiry as to the details of the recent pediatric mercury poisoning case in Cumberland, RI, which I learned of via the enclosed news article. As I mentioned to her, I have long been concerned that the magico-religious uses of elemental mercury in some Caribbean and Latino communities was resulting in the contamination of housing, and that this contamination would result in significant inhalation of mercury vapor and hence in the poisoning of the occupants.

Due to the persistence of mercury spills in porous substrates (see Carpi & Chen attached pdf), the bulk of these ritualistic mercury exposures are likely to be at second hand, as appears to be the case in this instance, where the female Dominican ritual expert (Santera?) had evidently spilled mercury on the carpeted floor by the altar in her bedroom. She then moved away, and the Columbian [Puerto Rican] family moved in, and vacuumed the carpeting, thus enormously increasing the mercury vapor levels which apparently resulted in the acrodynia of the 3 year old child. A classic case of second hand mercury vapor exposure.

I seem to remember that I had contacted you to discuss ritualistic mercury use some years ago, my call possibly precipitated by the Pawtucket, RI gas company mercury spill? I have been searching for a case that would convincingly demonstrate the connection between ritualistic mercury use, contamination of dwellings, and intoxication of the occupants of said dwellings, in order to convince environmental health agencies that this is a real current (albeit latent) threat, and not the "potential" health threat that Surgeon General Novello labeled it back in 1990 (see attached letter pdf). This appears to be such a case!

So, I am desirous of obtaining any documentation the RI DOH investigation and health findings related to the Cumberland case.

I would be much obliged for all information that would enable me to produce a coherent narrative of the clinical history, and of any evidence that links it with magico-religious mercury use. This case would make an excellent paper for *Environmental Health Perspectives* (see Garetano EHP 2006 attached). I am proposing that you and your colleagues at the RI DOH and the RI DEM might co-author such a paper?

As I mentioned to Ms. Beardsworth, I believe that this is not an isolated case, as acrodynia, the illness in the child (I believe that it was a 3 year old) who was responsible for the detection of the contamination, was a rather unusual response to mercury exposure, and many more are exposed but do not exhibit these clinical signs, and so the clinical community is not alerted to the domestic mercury contamination (see von Muhlen Dahl paper attached pdf).

So, I thank you in advance for your assistance and look forward to speaking with you in the near future.

Sincerely yours,

Arnold



http://www.wpri.com/dpp/news/local_news/blackstone/cumberland-child-mercury-exposure-RIDOH

Child recovering from mercury exposure

Mercury discovered at child's home

Updated: **Monday, 28 Feb 2011**, 9:49 PM EST
Published : Monday, 28 Feb 2011, 9:46 PM EST
Bill Tomison

CUMBERLAND, R.I. (WPRI) - After a Cumberland child contracted mercury poisoning, the Rhode Island Department of Health issued a warning about the risks of mercury.

According to a news release from the department Monday, the child was admitted to Hasbro Children's Hospital on Friday with elevated levels of mercury. The child was treated and is under doctors' care.

The DOH and DEM figured out the child had been exposed at home, and worked to remove the mercury contamination from the family's residence.

There were no details on exactly where the mercury came from, but officials said the elevated levels of mercury were contained to one house in Cumberland -- the address is not being released. They don't believe anyone else is at risk from the incident.

Mercury can still be found in the home in older thermometers, thermostats, newer fluorescent light bulbs, batteries -- even in some botanicals that may be used in religious or cultural traditions, the department said.

Symptoms of mercury exposure or poisoning (http://en.wikipedia.org/wiki/Mercury_poisoning) can include nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes and eye irritation. Long-term effects can include physical or neurological damage.

Click here to read more details on mercury risks at the health department's website.
(<http://www.health.nj.gov/healthrisks/poisoning/mercury.index.php>)

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http://www.state.nj.us/health/eoh/cehsweb/hcp_culturalmercury.html
on June 3, 2009]

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**Consumer, Environmental and
Occupational Health Service**

Public Health Services

Mercury and the Health Care Provider: Uncommon but Potentially Significant Exposures to New Jersey Residents

The New Jersey Department of Health and Senior Services is developing a website for health care providers on your patients' potential exposures to mercury from [cultural practices](#), consumer products, and other uncommon sources. These may be significant exposures to relatively small populations in NJ. While the full site is being developed, we are providing several of the background documents for your use.

Information on Mercury:

Case Studies in Environmental Medicine

Overview of Case studies in Environmental Medicine: These are developed by the Agency for Toxic Substances and Disease Registry/National Center for Environmental Health (ATSDR): The *Case Studies in Environmental Medicine* (CSEM) are a series of self-instructional modules designed to increase the primary care provider's knowledge of hazardous substances in the environment and to aid in the evaluation of potentially exposed patients. Continuing medical education (CME) for physicians, continuing nursing education (CNE) for nurses, continuing education units (CEU) for other professionals, and continuing education contact hours (CECH) for certified health education specialists (CHES) are offered in support of this series.

[Case Study in Environmental Medicine: Mercury Toxicity](#) [pdf 1m]. **PLEASE NOTE:** the "Standards and Regulations" portion of this case study is no longer current. For information on treatment, please contact the [New Jersey Poison Information and Education System](#) at 1-800-222-1222.

[Pediatric Environmental Health:](#) Mercury as a case study

[Case Studies in Environmental Medicine](#) (Complete set)

Medical Management Guidelines

Overview: The Medical Management Guidelines (MMGs) for Acute Chemical Exposures were developed by ATSDR to aid emergency department physicians and other emergency healthcare professionals who manage acute exposures resulting from chemical incidents. The MMGs are intended to aid healthcare professionals involved in emergency response to effectively decontaminate patients, protect themselves and others from contamination, communicate with other involved personnel, efficiently transport patients to a medical facility, and provide competent medical evaluation and treatment to exposed persons.

[Medical Management Guidelines: Mercury](#)
[Medical Management Guidelines: Complete set](#)

ToxFAQs CABS (Chemical Agent Briefing Sheets)

Overview: The ToxFAQs™ CABS provide current and relevant scientific information on specific high profile chemicals for public officials, business leaders, concerned citizens, and others to use in their work. The series presents a detailed overview of high profile hazardous materials that people may encounter during daily activities. The information provided in the ToxFAQs™ CABS can facilitate factual review and public discussion about these chemicals so that appropriate protective actions and potential research can be considered or undertaken to safeguard the physical environment and the public's health.

[ToxFAQs CAB Mercury](#)

[ToxFAQs CABS \(Complete set\)](#)

Toxicological Profiles

Overview of Toxicological Profiles: By Congressional mandate, the Agency for Toxic Substances and Disease Registry produces "toxicological profiles" for hazardous substances found at National Priorities List (NPL) sites. For the mercury toxicological profile, chapters 1 and 2 may be of particular interest to health care providers.

[Toxicological Profile: Mercury](#)

[Toxicological Profiles](#) (complete set)

Information on Cultural Uses of Mercury

Mercury may be used in certain religious and cultural practices, including Hindu and Asian traditional healing, and Afro-, Latin-, Caribbean-, and Brazilian-based traditions, including Santeria, Palo, Voodoo, and Espiritismo. Exposures to mercury can occur not only among individuals who use mercury in these practices, but to household members and others who live in the same buildings.

For information on religious and cultural practices that may use mercury, there are studies and websites that can provide you with more detailed information. A few of these are listed below.

Especially for Northern NJ health care providers: [A survey of mercury levels in air](#) was conducted in apartment buildings in **Union City and West New York, Hudson County, NJ**. The hallways of 34 multi-family buildings located within ½ mile of a botanica were tested for the presence of mercury in air. In two of the buildings the **indoor air concentration exceeded the USEPA's guidance**, and the source of these mercury levels is likely to have been a spill or intentional use of mercury in certain apartments. In five other buildings there was a suspicion of mercury use or spillage. Although this study cannot identify actual exposures to individuals, it does indicate the potential for exposures to residents of these buildings.

[Reports and websites:](#)

[Assessing Elemental Mercury Vapor Exposure from Cultural and Religious Practices](#): Environmental Health Perspectives • VOLUME 109 | NUMBER 8 | August 2001

[Cultural Uses of Mercury in New Jersey](#) . Summary Report. Environmental Assessment and Risk Analysis Element, NJDEP. May 2003.

[Religious Items/Ritual Uses of Mercury](#): The Northeast Waste Management Officials' Association (NEWMOA) website.

[Task Force on Ritualistic Uses of Mercury Report](#). USEPA; Dec. 2002

[The Use of Mercury for Cultural and Religious Purposes](#). Fact Sheet, National Association for County and City Health Officials.

[The Mercury Poisoning Project](#). compendium of relevant documents, resources, and links that describe the environmental health risks from mercury exposure associated with its cultural uses.

MAGICO-RELIGIOUS MERCURY USE AND ENVIRONMENTAL HEALTH - THE PROBLEM AND SUGGESTED SOLUTIONS

Arnold P. Wendroff, Ph.D.

Problems posed by magico-religious mercury use

There is a latent epidemic of mercury poisoning in some Caribbean-Latino communities, just as the current epidemic of pediatric lead poisoning was latent some 40 years ago. Research has demonstrated that elemental mercury (Hg) is put to a variety of magico-religious uses in Cuban, Dominican, Haitian, Puerto Rican, etc. communities, where in the context of folk magic, as well as in religions including Espiritismo, Santeria and Voodoo, mercury metal is generically believed to attract good and repel evil. Many of these ritualistic uses expose mercury to indoor air, where its developmentally neurotoxic vapor escapes and contaminates the dwelling. The most problematic, and one of the more common practices, is to sprinkle mercury on floors and furnishings of homes, and in the interior of automobiles. As this mercury is not cleaned up, it remains in porous surfaces such as flooring for decades. When disturbed, as by walking, sweeping, or vacuuming, the mercury liberates developmentally neurotoxic levels of mercury vapor. Therefore, the majority of the mercury vapor exposures are at second-hand, from historic ritualistic mercury spills. Those exposed can have no idea that their dwelling is contaminated, as the mercury droplets are hidden in crevices in the floor, and mercury vapor is invisible and odorless.

Ritualistic mercury exposure is overwhelmingly via inhalation, ~80% of inhaled mercury vapor entering the lungs is absorbed into the blood, where, prior to its oxidation, it is transported throughout the body. Being fat soluble, the elemental mercury passes into all tissues, including the brain, and via the placenta into the fetal circulation and the developing brain. In the tissues, mercury atoms combine with the molecules of intracellular structures, damaging them while forming insoluble mercury compounds, which remain in the damaged cells.

The EPA's evacuation level for mercury vapor in a dwelling is 10 micrograms of mercury per cubic meter of air, and the reoccupation level after cleanup, is 1 microgram per of

mercury per cubic meter of air. Mercury contamination is time-consuming and expensive to remediate. A small apartment that had ~10 grams of mercury sprinkled on its floor some years ago would easily cost several tens of thousands of dollars to decontaminate.

What we know about magico-religious mercury use

Elemental mercury is well documented as a potent toxin, especially to the central nervous system, although most of the data is from adult exposures and relatively little data exists on maternal-fetal and pediatric exposure. However, there is an enormous literature, and commensurate concern, on maternal-fetal and pediatric methylmercury exposure. Much of this literature is applicable to mercury vapor exposure, as it is the mercury atoms/ions that are toxic. There is no question that if mercury is sprinkled in homes in mean weights of ~10 grams, those homes will be semi-permanently contaminated with developmentally neurotoxic levels of mercury vapor.

Survey research has demonstrated the widespread nature of ritualistic mercury sales and use in some Caribbean-Latino communities. The best data on sales and presumed use are from the Bronx, NY, where in 1995 35 of 38 botanicas sold between ~25,000 and ~155,000 ~9 gram mean weight containers of mercury in 1995. Between ~8,000 and ~50,000 Bronx homes are believed to have had ~9 grams of that mercury sprinkled on their floors in 1995.

The best data on mercury use are from Lawrence, MA, where of 898 Dominicans interviewed, 12% had sprinkled mercury around a child's crib; 12% had sprinkled it in a car; 10% swallowed it in a drink; and 17% burned it in a candle or oil lamp.

We have data on elevated mercury vapor levels in public hallways of housing in two heavily Caribbean-Latino (~80% Cuban and Dominican) communities in New Jersey where mercury was widely sold for ritualistic uses.

We have data from children in the Bronx, NY where 5 of 100 had clinically elevated urine mercury levels believed to be from ritualistic exposure.

We have data on elevated mercury levels believed due to ritualistic use in wastewater emanating from Caribbean-Latino communities in New York City, and in water and sediments in the NY/NJ harbor.

Barriers to addressing the problem

The inherent political incorrectness of the issue, namely that poor ethnic and religious minorities are contaminating their own and their successor's homes with a potent neurotoxin within the context of their religious and magical beliefs.

The total lack of advocacy on the part of the Caribbean-Latino community, especially of their political, environmental, and medical elites, who are embarrassed by these magico-religious practices.

The mandated domestic evacuation level of 10 micrograms per cubic meter of mercury vapor.

The enormity of the cost of remediating mercury-contaminated housing, which government would incur.

The impacted nature of the problem, which had been identified two decades ago, and which, if real, will subject government to enormous legal and financial exposure, as well as embarrass individuals and organizations who have failed to act to assess and address this obvious environmental health threat.

Proposed next steps to address the problem

The key to addressing the issue is to demonstrate (or disprove) that housing in Caribbean-Latino communities is contaminated with mercury as a result of its magico-religious use. This is simple and cheap to do using a portable mercury-vapor analyzer to **non-invasively measure mercury levels in the public hallways of a representative sample of heavily Caribbean-Latino apartment buildings (especially public housing)** in communities (Bronx, NY; Union City, & West New York, NJ; Lawrence, MA) where ritualistic mercury was known to have been sold and used. Occupants of apartments emitting high levels of vapor would be notified, and requested to allow measurements of the vapor levels inside their homes. Occupants of contaminated apartments would be tested for elevated mercury levels and diagnosed for symptoms and signs of mercury poisoning.

Several local, state and federal government agencies have a mandate to perform such research, but to date have refrained from doing so. It has long been apparent to all familiar with the problem, that should this research be carried out, it would almost certainly result in demonstrating that very large numbers of homes are contaminated, and so would require their evacuation and decontamination, as well as demonstrating the failure of the system.

The utility of mercury vapor filters needs to be assessed, which if placed in mercury-contaminated homes, would allow the occupants to remain in them until the homes could be decontaminated.

Any health education programs must be based on informing the mercury-exposed communities of the reality of their potential mercury exposure and of its effects. The majority are exposed at second-hand, and are not ritualistic mercury users, and in many cases not of Caribbean or Latino ethnicity.

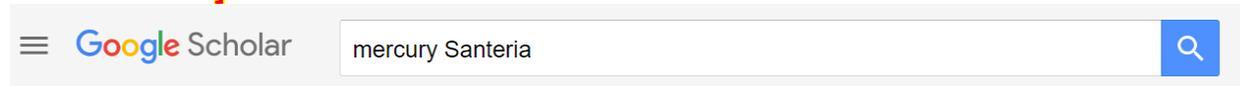
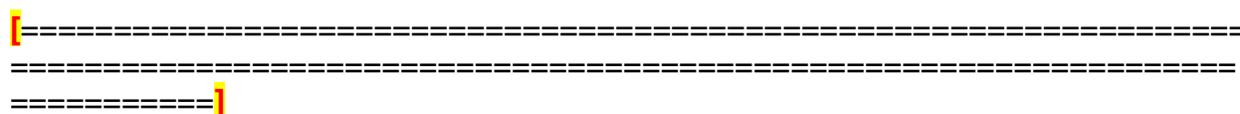
Medical practitioners serving mercury-contaminated communities need to be informed of these exposures and their clinical picture. This will raise their clinical suspicion and enable them to diagnose exposures which they are currently missing. Two examples of such attempts are www.state.nj.us:80/health/eoh/cehsweb/hcp_culturalmercury.html from New Jersey, and www.mercuryproject.org/pdf/metallic99.pdf ; www.mercuryproject.org

[ect.org/pdf/booklet99.pdf](#) from New York City. Government agencies (CDC, EPA, HUD, NIEHS) should issue requests for proposals from the environmental medical community to work collaboratively with community organizations to collect data on mercury vapor levels in housing, mercury levels in occupants of mercury-contaminated housing, and health effects of these domestic mercury vapor exposures.

November 18, 2009, Revised **February 24, 2011**

Mercury Poisoning Project

www.mercurypoisoningproject.org — Key Words < **mercury Santeria** > (718) 499-8336 [[Google Scholar](#) Key Words: <**mercury Santeria**> <**mercury Wendroff**>]



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... business, where **mercury**-filled amulets were reportedly prepared for practitioners of the AfroCaribbean religion **Santeria**. The oldest child found a 6-oz vial of **mercury** on the neighbor's ...
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... Few parents reported the presence of **mercury** at home, in a charm, or other item (eg, skin-... and a child's urinary **mercury** levels. All pediatric **mercury** levels measured in this study were ...

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... is sold as "azogue" in religious stores, or botanicas, for use in Esperitismo (spiritual belief in Puerto Rico), **Santeria** (... The form of **mercury** consumed in fish is mainly methyl **mercury**, and ...

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AP **Wendroff** - American Journal of Public Health, 1995 - ajph.aphapublications.org
... inadequately la-beled **mercury**. Such records provide data on the amount of **mercury** sold for magico... regarding the extent... of use of **mercury** in these practices." 4 (P3) Both EPA's and ...
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AP **Wendroff** - The Lancet Neurology, 2014 - thelancet.com
... , sprinkle **mercury** on floors and furnishings where it accumulates levels of **mercury** vapour, ... **Mercury** vapour, like methylmercury, is lipophilic and readily crosses the placental and blood...
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[CITATION] [Domestic mercury pollution](#)

AP **Wendroff** - Nature, 1990 - nature.com

... atmospheric **mercury** and speculated on its toxicity. Here, I report another novel source of **mercury** ... I believe this is the first mention of widespread domestic exposure to **mercury** vapour. ...

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[Polarized photoluminescence of liquid crystalline polymers with isolated arylenevinylene segments in the main chain](#)

JH **Wendroff**, G Lüsse, R Festag, A Greiner... - Advanced ..., 1995 - Wiley Online Library

... usually associated with the **mercury**-based superconductors. A ... presence of HgO to introduce **mercury** as the suitable [Hg₀]... the preparation of the superconducting **mercury**-cuprates.[8.

...

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[Comments on "Assessment of prenatal mercury exposure in a predominantly Caribbean immigrant community in Brooklyn, NY"](#)

A **Wendroff** - Journal of Environmental Monitoring, 2012 - pubs.rsc.org

... use of elemental **mercury** as a factor "associated with increased **mercury** levels in our study." Moreover, given the asserted absence of association between ritualistic **mercury** use and ...

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[Bodies at Rest: Rousing Officialdom to the Peril of Domestic Mercury Pollution](#)

AP **Wendroff** - Journal of Health Care for the Poor and Underserved, 1992 - muse.jhu.edu

... **mercury** ... **mercury** for occult purposes, and why there is now, in general, a greatly heightened awareness of the need to monitor and, if necessary, regulate the trade in elemental **mercury**...

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[Subcutaneous injection of mercury: "warding off evil"](#)

VL Prasad - Environmental Health Perspectives, 2004 - ehp.niehs.nih.gov

... In New York City, neurotoxic levels of **mercury** vapor from magicoreligious and ethnomedical uses of **mercury** have been reported (**Wendroff** AP, personal communication). Wastewater ...

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[Mercury use and exposure among Santeria practitioners: religious versus folk practice in northern New Jersey, USA](#)

C Alison Newby, DM Riley, TO Leal-Almeraz - Ethnicity and Health, 2006 - Taylor & Francis

... (**Wendroff** 1990; Zayas & Ozuah 1996; Chicago Department of Public Health 1997; Johnson 1999). **Mercury** ... containing approximately nine grams of **mercury** (**Wendroff** 1990). Reported ...

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[Response to comments on 'Assessment of prenatal mercury exposure in a predominately Caribbean immigrant community in Brooklyn, NY'](#)

LA Geer, MD Persad, CD Palmer... - Journal of ..., 2012 - pubs.rsc.org

... instance **Wendroff** loses sight of the primary goals of our study. We firmly reject **Wendroff's** assertion that we did not "adequately consider the role of magico-religious **mercury** use". In fact...

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AP **Wendroff** - The New England Journal of Medicine, 2004 - europepmc.org

The toxicology of **mercury**. - Abstract - Europe PMC ... The toxicology of **mercury**. **Wendroff** AP ...

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... neurotoxicity from exposure to **mercury** vapour. As elemental **mercury** might soon be added ... evidence-informed prevention of **mercury** exposures suggested by **Wendroff**. In writing our ...

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[CITATION] **Mercury Exposure from Magico-Religious Use in Hispanic and Caribbean Homes**

AP **Wendroff**, DA Jetter - unpublished draft, 11 p, 1997

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A reported by Warner - Health Perspect, 1996 - Citeseer

... than (methyl) **mercury** exposures from eating fish or from the leaching of **mercury** in amalgam fillings. Additionally, the **mercury** vapor released from **mercury** intentionally sprinkled on ...

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[CITATION] **CULTURAL USES OF MERCURY IN NEW JERSEY**

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[CITATION] **[MMA: DMA Ratios Reversed]: Response**

P Mushak - Environmental Health Perspectives, 1997 - JSTOR

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[Mercury vapor in residential building common areas in communities where mercury is used for cultural purposes versus a reference community](#)

G Garetano, AH Stern, M Robson... - Science of the total ..., 2008 - Elsevier

... In the latter we identified an accidental **mercury** spill from a bottle that had been brought into the building. Both the mean and maximum indoor **mercury** vapor levels were greater in the ...

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[PDF] [Mercury use in espiritismo: a survey of botanicas.](#)

LH Zayas, PO Ozuah - American Journal of Public Health, 1996 - ajph.aphapublications.org

... However, we recommend also that the dangers of **mercury** be sensitively separated from the social-psychological benefits of spiritualism. In inner-city Hispanic communities, espiritismo ...

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[Mercury exposure in an urban pediatric population](#)

PO Ozuah, MS Lesser, JS Woods, H Choi... - Ambulatory ..., 2003 - Elsevier

... elemental **mercury** exposure ... **mercury** (Hg), as a marker of exposure, in a population of children drawn from an inner-city community with documented easy access to elemental **mercury**. ...

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[Glutamate: a potential mediator of inorganic mercury neurotoxicity](#)

J Albrecht, E Matyja - Metabolic brain disease, 1996 - Springer

... and Von Karsa, 1990; **Wendroff**, 1990). **Mercury** enters the human body in the form of organic salts (methyl **mercury**), elemental **mercury** (**mercury** vapour) and inorganic salts, and there ...

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... **Wendroff**, related to the sale of elemental **mercury** in folk pharmacies or botanicas in the Los Angeles area. The EPA's Office of Enforcement took up the matter for consideration under ...

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[T Slayton - Environmental Health Perspectives, 1997 - ehp.niehs.nih.gov](#)

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[\[PDF\] **The toxicology of mercury**](#)

[DA Ross - The New England journal of medicine, 2004 - researchonline.lshtm.ac.uk](#)

... for reductions in **mercury** emissions from power plants, a major source of environmental **mercury** in fish. We support strict efforts to control **mercury** and other hazardous emissions from ...

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[\[PDF\] researchgate.net](#)

[\[PDF\] **A brief history of mercury and its environmental impact**](#)

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... **Mercury** is the only element that bears the name of a planet. The other metals named for, or ... The planet **Mercury** may bear this name because of its mobility (ie., messenger of the gods) ...

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[\[BOOK\] **An evaluation of potential exposure to mercury in a community where elemental mercury is used for cultural purposes**](#)

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... In communities with cultural **mercury** use, both peak and mean **mercury** vapor levels were significantly greater in residential building common areas than those in the reference ...

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[\[PDF\] **Comparison of indoor mercury vapor in common areas of residential buildings with outdoor levels in a community where mercury is used for cultural purposes**](#)

[G Garetano, M Gochfeld, AH Stern - Environmental Health ..., 2006 - ehp.niehs.nih.gov](#)

... As a first step in assessing this phenomenon, we compared **mercury** vapor concentration in ... where **mercury** is available and is used in cultural practices. We measured **mercury** using a ...

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Ultra trace mercury (II) detection by a highly selective new optical sensor

A Yari, F Papi - *Sensors and Actuators B: Chemical*, 2011 - Elsevier

... (vinyl chloride) membrane, is capable of determining **mercury**(II) with a high selectivity over a ... results for applications in direct determination of **mercury**(II) in environmental real samples ...

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■ ■ ■

Children's Exposure to Elemental Mercury Title Page
CHILDREN'S EXPOSURE to ELEMENTAL MERCURY
A NATIONAL REVIEW of EXPOSURE EVENTS
The Agency for Toxic Substances and Disease Registry
Centers for Disease Control and Prevention
Mercury Workgroup
February 2009
Children's Exposure to Elemental Mercury:

A National Review of Exposure Events

Reported by: The Agency for Toxic Substances and Disease Registry and Centers for Disease Control and Prevention Mercury Workgroup

Richard E. Besser, M.D.

February 2009

WORKGROUP MEMBERS

This report, titled "Children's Exposure to Elemental Mercury: A National Review of Exposure Events," was prepared by the Agency for Toxic Substances and Disease Registry (ATSDR) and the Centers for Disease Control and Prevention (CDC). The members of the internally convened workgroup have expertise in biomonitoring, environmental epidemiology, medicine, statistics, exposure investigation and assessment, state-led initiatives, toxicology, and management of mercury contamination in the environment.

1.1. Co-Chairs

Robin Lee, MPH - ATSDR/Division of Health Studies
Dan Middleton, MD, MPH - ATSDR/Division of Health Studies

1.2. Members

Kathleen L. Caldwell, PhD - CDC/Division of Laboratory Sciences
Steve Dearwent, PhD - ATSDR/Division of Health Studies
Steven Jones, MS - ATSDR/Division of Regional Operations
Brian Lewis - ATSDR/Division of Health Studies
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Helen S. Rogers, PhD - CDC/Division of Environmental Hazards and Health Effects
Michelle Watters, MD, PhD, MPH - ATSDR/Division of Regional Operations

p.8

The objectives of the workgroup were to:

- 1) identify the common sources of elemental mercury exposure in children; and
- 2) describe the location, demographics, and proportion of children exposed or potentially exposed to elemental mercury in the United States.

p.10

4.6. Discussion and Conclusions

Review of the data sources and literature found three categories of exposure scenarios. The first two categories are scenarios in the home and those at school, two common locations for childhood elemental mercury exposures. The third category includes exposures at other locations, such as medical clinics and property that was not adequately remediated. The sources of exposure in the home include mercury-containing devices, cultural or ceremonial uses of mercury, ...

p.12

5.2. Objectives

The objectives of the Mercury Workgroup were to:

- 1) identify the exposure sources associated with elemental mercury exposure in children; and
- 2) describe the location, demographics, and proportion of children exposed or potentially exposed to elemental mercury in the United States.

The Mercury Workgroup reported on elemental mercury exposures that typically occur when children inhale mercury vapor related to:

- disposal or damage to mercury devices (e.g., thermometers or lightbulbs);
- off-gassing of mercury vapors from flooring materials;
- proximity to industrial sites or hazardous waste sites contaminated with mercury;
- reuse of industrial property contaminated with mercury;
- residential contamination caused by religious or cultural practices; and
- release of mercury found in school science laboratories or health care facilities.

p.13

Indoor mercury spills that are not properly cleaned up can release mercury vapors into the air for weeks or even years [ATSDR 1999].

6.2. Toxicokinetics of Elemental Mercury

When human volunteers were exposed to mercury vapor, the estimated uptake rate through the skin was approximately 2% of the uptake rate through the lungs [Hursh et al. 1989].

Even the small amount of mercury in a typical thermometer (0.5 to 3.0 g mercury or 0.04 to

0.22 ml mercury) can create hazardous conditions if spilled indoors and improperly cleaned [Smart 1986; von Muhlendahl 1990].

p.14

Some Caribbean religions and folk healers use mercury for religious or ceremonial purposes [Wendroff 2005]. The ceremonial uses of mercury include applying it to the skin, adding it to candles, or sprinkling it around the home. Elemental mercury is easily dispersed into fine beads that sink into carpets, furniture, cracks in the floor, or other porous materials (Figure 1a, 1b). Mercury tracked from room to room produces widespread contamination throughout the house. These practices can potentially expose practitioners and their children. Following indoor spills, mercury can persist for months and even years [Carpi and Chen 2001]. Therefore ceremonial use of mercury in the home could also expose future occupants and their children.

Occasionally, mercury contamination is so extensive that adequate cleaning is not possible and the building must be demolished [Orloff et al. 1997].

In addition, school science laboratories may store elemental mercury and various types of mercury-containing equipment, such as thermometers and barometers.

p.15

Mercury is also measurable in hair. However, these tests primarily measure organic mercury [Aposhian et al. 1992; ATSDR 2001c; Cianciola et al. 1997; Kingman et al. 1998], and are not useful for assessing recent exposures to elemental mercury.

p.28

10.1. Exposure at Home

The sources of exposure in the home include ... cultural or ceremonial uses of mercury, ...

A mercury vapor absorbing filter system was used in the bedroom for 3 months to remove residual mercury vapors.

p.29

Cultural or Ceremonial Uses. Some practitioners of certain Caribbean and Latin American religions, such as Voodoo, Santeria, Palo, and Espiritismo, use mercury ceremonially [EPA 2002; Johnson 1999; Newby et al. 2006; Wendroff 2005; Zayas and Ozuah 1996]. Ceremonial uses of mercury include applying it to the skin, adding it to candles, or sprinkling it around the home. These practices can potentially expose practitioners and their families. Because mercury contamination in the home can persist for years, ceremonial use of mercury in the home could expose future occupants and their children, contributing to health disparities in these populations.

Previous reports document the ceremonial use of mercury in neighborhoods whose residents are largely Hispanic [JSI 2003; Ozuah et al. 2003; Rogers et al. 2008; Rogers et al. 2007; Zayas and Ozuah 1996]. The John Snow, Inc. Center for Environmental Health Studies [2003] reported a survey of 898 persons, most of whom had Latino or Caribbean backgrounds. In this survey, 344 of the 898 people (38%) reported that they used or knew someone who used mercury for religious, spiritual, or health purposes. Garetano et al. [2008] found that mercury vapor levels were higher among residential common areas belonging to communities likely to use

mercury for cultural practices than control areas where cultural mercury use is uncommon. However, all mercury vapor levels observed by Garetano et al. [2008] were below the ATSDR minimum risk level for chronic inhalation of metallic mercury [ATSDR 1999]. An exposure assessment by Rogers et al. [2007] tested the urine mercury levels of 306 children who lived in an area where elemental mercury [p.30] was commonly sold for ritualistic use. Although no relationship between ritualistic use and mercury exposure was evident, Rogers et al. [2007] concluded that potential health hazards remain when mercury is readily available. In a similar study, urine mercury levels were measured in 100 children that resided in an area where elemental mercury was commonly sold for religious practices. Five percent of these children had urine mercury levels above 5 µg/L [Ozuah et al. 2003; Zayas and Ozuah 1996].

10.2. Exposure at School

The most common elemental mercury sources in schools are mercury stored in science laboratories, mercury found in broken instruments, and mercury brought to school from other locations.

p.31

10.3. Exposures in Other Locations

Prior Industrial Mercury Contamination. In most situations the reuse of industrial property **does not result** in childhood mercury exposure.

p.33

11. LIMITATIONS

Concerns regarding personal responsibility for causing a spill or having to clean up a spill may influence the quality and completeness of the information reported. Spills in private residences may be under reported because the residents are unaware of the health hazard and the need to report spills ... In addition, the published literature is likely biased toward reporting worst-case scenarios, as opposed to **the more typical exposures that do not cause symptoms or attract attention.**

Case reports from the literature provide more information about risk factors, exposure scenarios, and associated health outcomes. The specifics relate to the individual cases and are not representative of all exposure scenarios.

p. 34

12. DISCUSSION

p.35

12.2. Describing the Location, Demographics, and Proportion of Children Affected

Neither urine nor blood mercury levels correlate well with the presence or severity of symptoms [Cherry et al. 2002; Gattineni et al. 2007; Tominack et al. 2002].

Although the extent of mercury use in the home for religious purposes is not well characterized, **such use may lead to chronic mercury exposure among those who use it in this manner and for subsequent occupants** of the contaminated homes. Some

evidence suggests that attempting to ban mercury could drive its use and sales underground, making the risks of using mercury and the benefits of mercury-free alternatives difficult for local health officials to communicate [Riley et al. 2001]. **The individuals affected are most likely to be members of minority populations, raising concerns about environmental injustice in these communities.**

13. CONCLUSIONS

p.36

Although credibly estimating the frequency of elemental mercury exposures among children in the United States is not possible, such exposures are occurring. These incidents typically result from the misuse of mercury-containing equipment or a lack of knowledge regarding the hazard.

Initiatives that affect the number of children exposed have focused on reducing or removing mercury from consumer products, eliminating mercury from school science laboratories, and educating the public and school officials about its toxicity.

p.37

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[Verbatim excerpts relating to magico-religious mercury use.]

"There is an urgent need to obtain information on the levels of exposure from these practices to determine if children or adults are at risk. Mercury vapor concentrations may be much higher after use during the winter months when the heat is turned on and the windows are closed, so data that reflect a variety of possible exposure scenarios are also needed." **p. 480**

TOXICOLOGICAL PROFILE FOR MERCURY

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service

Agency for Toxic Substances and Disease Registry

March 1999

p.7

Some religions have practices that may include the use of metallic mercury. Examples of these religions include Santeria (a Cuban-based religion whose followers worship both African deities and Catholic saints), Voodoo (a Haitian-based set of beliefs and rituals), Palo Mayombe (a secret form of ancestor worship practiced mainly in the Caribbean), and Espiritismo (a spiritual belief system native to Puerto Rico). Not all people who observe these religions use mercury, but when mercury is used in religious, ethnic, or ritualistic practices, exposure to mercury may occur both at the time of the practice and afterwards from contaminated indoor air. Metallic mercury is sold under the name "azogue" (pronounced ah-SEW-gay) in stores called "botanicas." Botanicas are common in Hispanic and Haitian communities, where azogue may be sold as an herbal remedy or for spiritual practices. The metallic mercury is often sold in capsules or in glass containers. It may be placed in a sealed pouch to be worn on a necklace or in a pocket, or it may be sprinkled in the home or car. Some people may mix azogue in bath water or perfume, or place azogue in devotional candles. Because metallic mercury evaporates into the air, these practices may put anyone breathing the air in the room at risk of exposure to mercury. The longer people breathe the contaminated air, the greater their risk will be. The use of metallic mercury in a home or an apartment not only threatens the health of the people who live there now, but also threatens the health of future residents who may unknowingly be exposed to further release of mercury vapors from contaminated floors or walls.

p. 20

If you use metallic mercury or azogue in religious practices, you may expose your children or unborn child to mercury or contaminate your home. Such practices in which mercury containing substances have traditionally been used include Santeria (a Cuban-based religion whose followers worship both African deities and Catholic saints), Voodoo (a Haitian-based set of beliefs and rituals), Palo Mayombe (a secret form of ancestor worship practiced mainly in the Caribbean), or Espiritismo (a spiritual belief system native to Puerto Rico).

p. 227

Some religions have practices that may include the use of metallic mercury. Examples of these religions include Santeria (a Cuban-based religion that worships both African deities and Catholic saints), Voodoo (a Haitian-based set of beliefs and rituals), Palo Mayombe (a secret form of ancestor worship practiced mainly in the Caribbean), and Espiritismo (a spiritual belief system native to Puerto Rico). Not all people who observe these religions use mercury, but when mercury is used in religious, folk, or ritualistic practices, exposure to mercury may occur both at the time of the practice and afterwards from breathing in contaminated indoor air. Metallic mercury is sold under the name "azogue" (pronounced ah-SEW-gay) in stores called "botanicas." Botanicas are common in Hispanic and Haitian communities, where azogue maybe sold as an herbal remedy or for spiritual practices. The metallic mercury is often sold in capsules or in glass containers. It may be placed in a sealed pouch to be worn on a necklace or carried in a pocket, or it may be sprinkled in the home or car. Some store owners may also suggest mixing azogue in bath water or perfume, and some people place azogue in devotional candles. The use of metallic mercury in a home or apartment not only threatens the health of the current residents, but also poses health risks to future residents, who may unknowingly be exposed to further release of mercury vapors from contaminated floors, carpeting, or walls.

p. 378

In addition, unknown quantities of metallic mercury used in religious or ethnic ceremonies, rituals, and practices (see Sections 5.4.4, 5.6, and 5.7) may reach municipal landfill sites by being improperly disposed of in domestic garbage, or may reach POTWs by being improperly discarded into domestic toilets or sink drains (Johnson [in press]). A survey was conducted to determine the use patterns of elemental mercury in the Latin American and Caribbean communities in New York City (Johnson [in press]). In a survey of 203 adults, about 54% used elemental mercury in various religious and ethnic practices. Of these users, 64% disposed of the mercury in household garbage, 27% flushed the mercury down the toilet, and 9% disposed of the mercury outdoors. It is commonly thought that the high mercury load found in sewage and garbage in New York City comes from dental clinics; however, improper disposal of mercury by religious practitioners in the Latin American and Caribbean communities may also contribute to this load (Johnson [in press]).

p. 429

Metallic mercury has been used by Mexican American and Asian populations in traditional remedies for chronic stomach disorders (Espinoza et al. 1995; 1996; Geffner and Sandler 1980; Trotter 1985). Most recently, Perharic et al. (1994) reported cases of poisonings resulting from exposure to traditional remedies and food supplements reported to the National Poisons Unit in London, England. From 1989 to 1991, elemental mercury was implicated in several poisonings following exposure to traditional Asian medicines. In one case, the mercury concentration in the medicinal product taken orally was 540 mg/g (540,000 ppm). The mercury was in its elemental or metallic form. Espinoza et al. (1995, 1996) reported that while examining imported Chinese herbal balls for the presence of products from endangered species, the authors detected potentially toxic levels of arsenic and mercury in certain herbal ball preparations. Herbal balls are aromatic, malleable, earth-toned, roughly spherical, hand-rolled mixtures primarily composed of herbs and honey that are used to make medicinal teas. These herbal balls are used as a self-medication for a wide variety of conditions, including fever, rheumatism, apoplexy, and cataracts. Herbal balls similar to those analyzed are readily available in specialty markets throughout the United States. Mercury (probably mercury sulfide) was detected in 8 of the 9 herbal balls tested. The recommended adult dose for the herbal balls is two per day. Ingesting two herbal balls could theoretically provide a dose of up to 1,200 mg of mercury.

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Religious and Ethnic Rituals, Ceremonies, and Practices. While some of medicinal and pharmaceutical uses of mercury compounds have been replaced in recent years, individuals in some ethnic or religious groups may still use mercury in various religious or ethnic rituals, practices, and ceremonies that can expose them to elevated mercury concentrations in room air. Metallic mercury has been used in Latin American and Caribbean communities as part of certain religious practices (e.g., Voodoo, Santeria, and Espiritismo), predominantly in domestic settings (Wendroff 1990). This use of mercury can contaminate a dwelling or automobile if the mercury is not completely removed from flooring, carpeting, and woodwork in an appropriate manner. Metallic mercury (sometimes under the name *azogue*) currently is sold in shops called botanicas which stock medicinal plants, traditional medicines, incense, candles, and perfumes. Botanicas typically dispense mercury in gelatin capsules or sometimes in small glass vials. Some religious practices involve sprinkling metallic mercury on the floor of the dwelling or of a car, mixing metallic mercury with soap and water to wash the floor, or placing it in an open container to rid the house of evil spirits. Other practices involve carrying a small amount of mercury in a vial on the person, or mixing mercury in bath water or perfumed soaps, devotional candles, ammonia or camphor. Any of these practices can liberate mercury vapor into the room air, exposing the occupants to elevated levels of mercury vapors (ATSDR 1997; Wendroff 1990, 1991). In addition to the individuals that intentionally use mercury in their dwellings, the opportunity exists for nonusers to be inadvertently exposed when they visit the dwelling, or purchase or rent dwellings in which the former tenants used mercury for religious purposes. The issuance of cautionary notices and information by health departments to members of these user populations is appropriate.

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Children can be exposed to various forms of mercury in a variety of ways, including playing with unsecured elemental mercury, inhalation of mercury vapors via the religious or ethnic practices of their parents or unintentional spills of elemental mercury, oral ingestion of herbal or ethnic remedies or mercury-containing consumer products, ...

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Children may be exposed to mercury vapors when they play with metallic mercury. Metallic mercury is a heavy, shiny, silver liquid and when spilled, forms little balls or beads which fascinate children. ...

Metallic mercury is traditionally used in some religious rituals or remedies, including religions such as Santeria (a Cuban-based religion that worships both African deities and Catholic saints), voodoo (a Haitian based set of beliefs and secret rites), Palo Mayombe (a secret form of ancestor worship practiced mainly in the Caribbean), or Espiritismo (a spiritual belief system native to Puerto Rico) (Wendroff 1990). If these rituals or spiritual remedies containing mercury are used in the home, children may be exposed and the house may be contaminated with mercury (ATSDR 1997; Johnson [in press]; Wendroff 1990, 1991; Zayas and Ozuah 1996). Metallic mercury is sold under the name "azogue" (pronounced ah-SEW-gay) in stores (sometimes called botanicas) which specialize in religious items and ethnic remedies (Johnson [in press]; Wendroff 1990; Zayas and Ozuah 1996). Azogue may be recommended by family members, spiritualists, card readers, and santeros. Typically, azogue is carried on one's person in a sealed pouch, or it is ritually sprinkled in the home or car. Some store owners suggest mixing azogue in bath water or perfume. Some people place azogue in devotional candles. Because metallic mercury evaporates into the air, there is a potential health risk from exposure to mercury vapors in a room where the mercury is sprinkled or spilled onto the floor, put in candles, or where open containers of metallic mercury are present (ATSDR 1997; Wendroff 1990, 1991). Young children spend a lot of time crawling on the floor

and carpeting, so they may be subject to a higher risk of exposure, especially when mercury is sprinkled on the floors or carpets. Very small amounts of metallic mercury (i.e., a few drops) may raise air concentrations of mercury to levels that could be harmful to health (ATSDR 1997). Metallic mercury and its vapors are extremely difficult to remove from clothes, furniture, carpet, floors, walls, and other such items. The mercury contamination can remain for months or years, and may pose a significant health risk for people continually exposed (ATSDR 1997; Johnson [in press]; Wendroff 1990, 1991).

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Individuals Exposed to Consumer Products and Medicinal Products Containing Mercury.

Individuals who use various consumer products containing mercury (i.e., medicinal herbal remedies, skin lightening creams and soaps, laxatives, tattoo dyes, fingerpaints, and make-up paints) are also exposed to higher mercury levels than the general population (Barr et al. 1973; Dyall-Smith and Scurry 1990; Espinoza et al. 1995; Geffner and Sandler 1980; Lauwerys et al. 1987; Rastogi 1992; Wendroff 1990). Metallic mercury has been used by Mexican American and Asian populations in traditional remedies for a variety of medical conditions, including chronic stomach disorders. Several papers have been published related to the use of metallic mercury as a folk remedy (ATSDR 1992, 1997; Department of Health 1997; Geffner and Sandler 1980; Hartman 1995; Johnson [in press]; Trotter 1985; Wendroff 1990, 1991; Zayas and Ozuah 1996). Some Mexican-Americans believe that disorders of the alimentary tract may be caused by a bolus of food adhering to the stomach wall, a condition known as *empacho*. Geffner and Sandler (1980) reported cases of two young patients with acute gastroenteritis who received traditional remedies of oral administration of metallic mercury, presumably to dislodge the bolus. Both patients were successfully treated and released from the hospital after 2 and 10 days of treatment, respectively. Trotter (1985) reported that metallic mercury known as *azogue* is in common use in New Mexico and the bordering areas for treating this gastrointestinal condition, *empacho*.

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Individuals that Use Mercury in Religious Ceremonies and/or Ethnic Practices or Live in Dwellings where Intentional or Unintentional Elemental Mercury Spills have Occurred.

Metallic mercury has been used in Latin American and Caribbean communities as part of certain religious practices (e.g., Voodoo, Santeria, and Espiritismo) predominantly in domestic settings (Wendroff 1990). Metallic mercury is sold in shops called *botanicas* (sometimes under the name *azogue*) which stock medicinal plants, magical medicines, incense, candles, and perfumes. *Botanicas* typically dispense mercury in gelatin capsules or, sometimes, in small glass vials. Some practices involve sprinkling metallic mercury on the floor of the dwelling or of a car, mixing elemental mercury with soap and water to wash the floor, or placing it in an open container to rid the house of evil spirits. Other practices involve carrying a small amount of mercury in a vial on the person or mixing mercury in bath water or perfumed soaps, devotional candles, ammonia, or camphor. Any of these practices can liberate mercury vapor into the room air exposing the occupants to unnecessarily elevated levels of mercury vapors (ATSDR 1997; Wendroff 1990, 1991). The issuance of cautionary notices by health departments to members of these user populations may be appropriate. While some medicinal and pharmaceutical uses of mercury compounds have been replaced in recent years, individuals in some religious and ethnic groups may still use mercury in various rituals. This use of mercury can contaminate the dwelling if the mercury is not removed from flooring, carpeting, and woodwork in an appropriate manner.

A unique exposure pathway that has received little research attention is the exposure to children from religious and ethnic uses in homes and cars or in remedies containing metallic mercury (ATSDR 1997; Johnson [in press]; Wendroff 1990, 1991). In some religious practices of Latin American or Caribbean origin, there are traditional rituals or remedies that involve mercury. These include intentional sprinkling of liquid elemental mercury on the floor, burning candles made with mercury, using mercury in baths, adding it to perfume, or wearing small containers of mercury around the neck for good luck. **There is an urgent need to obtain information on the levels of exposure from these practices to determine if children or adults are at risk.** Mercury vapor concentrations may be much higher after use during the winter months when the heat is turned on and the windows are closed, so data that reflect a variety of possible exposure scenarios are also needed.

Elemental Mercury Poisoning Presenting as Hypertension in a Young Child

Elizabeth H. Brannan, MD,* Sharon Su, MD,*† and Brian K. Alverson, MD*†

Abstract: Mercury intoxication is an uncommon cause of hypertension in children and can mimic several other diseases, such as pheochromocytoma and vasculitis. Mercury intoxication can present as a diagnostic challenge because levels of catecholamines may be elevated, suggesting that the etiology is a catecholamine-secreting tumor. Once acrodynia is identified as a primary symptom, a 24-hour urine mercury level can confirm the diagnosis. Inclusion of mercury intoxication in the differential diagnosis early on can help avoid unnecessary and invasive diagnostic tests and therapeutic interventions. We discuss a case of mercury intoxication in a 3-year-old girl presenting with hypertension and acrodynia, without a known history of exposure. Chelation therapy successfully treated our patient's mercury intoxication. However, it was also necessary to concurrently treat her hypertension and the pain associated with her acrodynia. Because there were no known risk factors for mercury poisoning in this case, and because ritual use of mercury is common in much of the United States, we recommend high clinical suspicion and subsequent testing in all cases of acrodynia.

Key Words: mercury poisoning/toxicity, hypertension, acrodynia, chelation therapy

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Elemental mercury intoxication is a rare cause of hypertension in children¹ but has potential for serious morbidity and can mimic several other serious conditions, including catecholamine-secreting tumors, Kawasaki disease, stimulant ingestion, and vasculitis. Elemental mercury intoxication affects, with varying degrees, the central and peripheral nervous systems, the cardiovascular system, the kidneys, the lungs, the gastrointestinal tract, and the skin, depending on the dose and chronicity of exposure.^{2,3}

In the 19th and early 20th centuries in the United States, children in particular were exposed to elemental mercury in the form of laxatives and diaper and teething powders.² Present-day sources of elemental mercury exposure include thermometers, disk batteries, fluorescent light bulbs, sphygmomanometers, latex paint, and dental amalgams, as well as certain cultural and religious practices and industrial processes.^{2–4} We present here a case of a child with elemental mercury intoxication that raises implications for the differential diagnosis and evaluation of hypertension in children and highlights the need for further evidence-based recommendations for treatment of mercury intoxication and interim management of mercury-induced hypertension and acrodynia.

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CASE

A 3-year-old girl presented with 3 weeks of intermittent abdominal pain, diaphoresis, and tachycardia. Four days before admission, she developed pain in her hands and feet. On presentation she was hypertensive, with blood pressure of 158/100 mm Hg while calm. The patient's initial examination revealed a thin, diaphoretic girl with tachycardia and a hyperdynamic precordium, a diffusely tender but soft abdomen, and a normal result in the neurological examination aside from irritability. She had warm, erythematous, edematous palms and soles with intermittently appearing papules and desquamation, as well as a pruritic, erythematous, maculopapular rash over her chest and back. Her systemic symptoms were episodic throughout the day, and she appeared anxious during the episodes. Her extremity findings were consistent with acrodynia—an idiosyncratic hypersensitivity reaction to mercury exposure.⁵ On further examination of history, the patient's mother reported that there had been no fish ingestion in the last month. They also denied any broken thermometers in the house, burning of batteries or fluorescent lamps, contact with miners, steel workers, or with people working in cement factories or crematoria. They denied the patient had any recent ingestion of paint or new toys and stated that the patient did not regularly put toys in her mouth. The mother did, however, note that the family moved into a new apartment 2 months before presentation.

The patient had symmetrically elevated blood pressure in 4 extremities, unremarkable echocardiogram and electrocardiogram, and a normal result on fundoscopic examination. Her initial electrolytes, creatinine, and urinalysis were all normal and remained so on serial evaluations. Urine drug screen was negative. Thyroid function panel and levels of renin and aldosterone were normal. An abdominal plain film was unremarkable. Plasma metanephrine and plasma and urine catecholamine levels were elevated, suggestive of pheochromocytoma (Table 1). A magnetic resonance imaging (MRI)/angiography of the abdomen and MRI of the chest and pelvis showed no masses or renal artery stenosis, and an MRI of the brain and neck showed no masses or other abnormalities. Given the patient's persistent hypertension, tachycardia, diaphoresis, irritability, acrodynia, and elevated catecholamine levels without evidence of a tumor on imaging, mercury toxicity was suspected, despite absence of any known exposure. A 24-hour urine mercury sample was elevated at 60 μg (reference range, 0–20 $\mu\text{g}/24$ h).

The patient was started on oral chelation therapy with dimercaptosuccinic acid (DMSA) 16 mg/kg divided twice daily. Her hypertension was controlled with labetalol and amlodipine. One week after initiation of therapy, her urine mercury level rose to 178 μg , but after 2 weeks on therapy, it began to drop and she was continued on therapy for approximately 2.5 months (Fig. 1). Creatinine levels and results in liver function tests during chelation therapy remained normal. She required antihypertensive therapy for 2 months. At 3 months of follow-up, the patient was normotensive off medication, her acrodynia and irritability had resolved, and plasma metanephrine levels normalized.

TABLE 1. Laboratory Evaluation

Free T ₄ (reference range, 0.8–1.8 ng/dL)	1.8 ng/dL
TSH (reference range, 0.35–5.5 uIU/mL)	3.85 uIU/mL
Plasma renin activity (reference range, 100–650 ng/dL per hour)	542 ng/dL per hour
Aldosterone (reference range, 2–37 ng/dL)	16 ng/dL
Plasma	
Total metanephrine (reference range, ≤205 pg/mL)	424 pg/mL
Normetanephrine (reference range, ≤148 pg/mL)	392 pg/mL
Dopamine (reference range, 0–135 pg/mL)	<20 pg/mL
Norepinephrine (reference range, 0–600 pg/mL)	1474 pg/mL
Epinephrine (reference range, 0–90 pg/mL)	149 pg/mL
24-h urine	
Total metanephrine (reference range, 0–900 μg/d)	797 μg/d
Norepinephrine (reference range, 4–29 μg/d)	119 μg/d
Epinephrine (reference range, 0–6 μg/d)	33 μg/d
Dopamine (reference range, 40–260 μg/d)	284 μg/d

T₄ indicates thyroxine; TSH, thyroid-stimulating hormone.

The state Department of Health was notified when the patient’s urine mercury level returned elevated, and investigation by the Department of Environmental Management revealed elevated mercury levels throughout the home and levels above 30,000 ng/m³ in the master bedroom, whereas a limit of 1000 ng/m³ has been set as the safe level for occupancy. Neighbors reported that the previous tenant was a Columbian woman who practiced rituals in the home that involved the use of mercury. Such practices are well described in the literature, and elemental mercury is obtainable at community botanicas.⁴

DISCUSSION

This case report highlights the importance of including mercury intoxication in the differential diagnosis of children with hypertension, even in the absence of known exposure, and particularly when symptoms suggest pheochromocytoma. Mercury interferes with the catabolism of catecholamines by inactivating a coenzyme used by catecholamine-*O*-methyltransferase, resulting in accumulation of norepinephrine, epinephrine, and dopamine in the blood and urine.¹ This is responsible for both the pheochromocytoma-like symptoms (hypertension, diaphoresis, tachycardia) and the laboratory findings (elevated levels of plasma and urine catecholamines and metanephrines) associated with mercury intoxication. Mercury intoxication should be considered in any child in whom a catecholamine-secreting tumor is suspected.

In this particular case, with no tumor visible on MRI and before the result of the urine mercury level, the diagnosis of erythromelalgia was also considered. Erythromelalgia is a rare condition composed of episodic erythema, warmth, and burning pain in the extremities.⁶ Primary erythromelalgia can begin spontaneously at any age, and new research suggests a hereditary component involving mutation in the Na_v1.7 voltage-gated sodium channel.⁷ Secondary forms are associated with underlying illness such as myeloproliferative and autoimmune diseases. Symptoms are triggered by warm temperatures, and patients often find relief by cooling the affected extremities. Interestingly,

our patient did find comfort in running her hands under cold water. The pathophysiology has yet to be fully characterized but is believed to be due to vascular shunting and reactive hyperemia.⁶

Management of this patient’s hypertension was complicated by the combination of increased sympathetic nervous system activity and persistent pain resulting from this patient’s acrodynia. In addition, the choice of antihypertensive agents had an impact on imaging modalities. Given that her symptoms were most suggestive of an elevated catecholamine-like state, labetalol was chosen because of its combined blockade of α- and β-adrenergic activities. Selectively blocking only α- or β-adrenoreceptors can result in overstimulation of the unblocked pathway, so it is recommended that both adrenoreceptors be inhibited. Her blood pressures were only partially controlled on labetalol. When imaging failed to demonstrate a tumor and vasculitis was suspected, calcium channel blockers (CCB)—amlodipine and isradipine—were added to her antihypertensive regimen. It was postulated that hypertension from vasculitis may result from endothelial dysfunction of the vasculature, and CCBs may inhibit this process. When no laboratory data supported a diagnosis of vasculitis, meta-iodobenzylguanidine (MIBG) scan was considered to identify any catecholamine-secreting tumor. However, labetalol and CCBs have been shown to reduce uptake of MIBG and lead to false-negative scans,⁸ so there was consideration of switching her to other blood pressure agents, such as an angiotensin-converting enzyme inhibitor and a vasodilator. Fortunately, her urine mercury level came back elevated, and a MIBG scan was no longer indicated.

Hypertension resulting from mercury toxicity often requires more than 1 class of antihypertensive medication. Case reports have described the simultaneous use of up to 4 different antihypertensives.^{1,5} Our report describes the successful management of this patient’s hypertension with the dual therapy of labetalol 4.5 mg/kg per day and amlodipine 0.4 mg/kg per day. The emphasis placed on adequate pain management and the use of topical mexiletine to the hands and feet and oral gabapentin may have contributed to the successful control of her blood pressures.

In the literature, nephrotoxic effects from mercury exposure often present as nephrotic syndrome.^{9–12} Occasionally, reversible renal tubular dysfunction has also been reported.¹³ Fortunately, the patient did not develop either sign of renal toxicity. There is no specific therapy to treat the nephrotoxic effects of

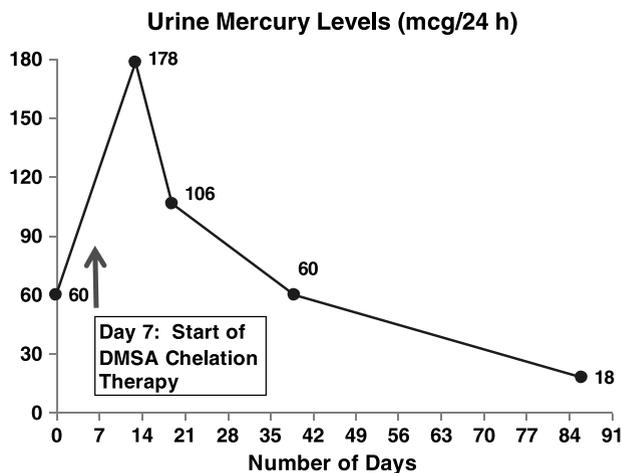


FIGURE 1. Urine mercury levels from diagnosis through treatment with DMSA.

mercury poisoning, but removal of the heavy metal by chelation can reverse the nephrotic syndrome and tubular defects.^{14,15}

The patient received chelation therapy with DMSA. As expected, her urine mercury level initially rose on starting chelation therapy (Fig. 1) because the mercury was liberated from her body tissues, but then it began to drop and eventually normalized. Of note, DMSA is the most frequently used oral chelation therapy for mercury toxicity in children, but treatment remains controversial, and several studies suggest no clear clinical benefit of chelation with DMSA in people with elemental mercury poisoning.¹⁶ Some suggest that natural clearance of mercury in the urine follows a linear 1-compartment elimination model.¹⁷ In our case, the fact that the urine levels rose after DMSA administration implies that chelation was effective.

Clinical suspicion for mercury toxicity should remain high in the absence of risk factors. The use of mercury in religious practice is well described; however, the extent of this problem is hard to understand or measure.¹⁸ Sale of elemental mercury from botanicas for the purposes of sprinkling about the home is not uncommon.^{4,19} One screening study in New York City demonstrated that 5% of healthy pediatric volunteers had unexpected elevated urinary mercury levels.²⁰

CONCLUSIONS

This case illustrates that evaluation for mercury exposure should be considered when there is presentation of hypertension and acrodynia, even in the absence of a known exposure. Selection of appropriate antihypertensive medications in the setting of increased catecholamines is challenging given the diagnostic possibilities. Management of mercury toxicity includes not only chelation therapy but also supportive care, particularly providing adequate pain control for the patient. The availability of elemental mercury at community botanicas and its use in cultural practices also represents a public health concern that warrants further attention.

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Gaseous Elemental Mercury as an Indoor Air Pollutant

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Mercury is not commonly considered a household air pollutant; however, a number of potential sources of the metal exist in residential settings. Eleven of 12 indoor sites sampled in this study showed levels of airborne mercury that were significantly elevated over outdoor concentrations (range 6.5–523 ng m⁻³). In addition, this and other published research suggest that up to 10% of households may have levels of airborne mercury above the U.S. EPA reference concentration (300 ng m⁻³) due to historic accidents with mercury containing devices. Exposure to mercury via indoor air is seen as second only to fish consumption as a source of mercury in the general population. Large seasonal changes in indoor mercury levels were identified in this study suggesting that short-term monitoring of mercury-contaminated sites is not sufficient to adequately assess the potential health risks and effectiveness of remediation strategies.

Introduction

While the adverse health effects associated with exposure to mercury have been known since antiquity, the unique chemical and physical properties of the metal have entrenched its use in modern society. As a result, mercury contamination in the environment is widespread. Mercury pollution is the leading cause of health advisories on fishing resources in the United States, and it is the only pollutant for which the number of advisories continues to increase (1).

Fish consumption is the primary source of exposure to mercury in the general population of the United States and many other countries because of the high bioaccumulation rate of methyl mercury in the aquatic food chain. Exposure to mercury in drinking water is minor, and exposure to mercury via inhalation is thought to be insignificant due to the low levels of mercury in outside air. Aside from isolated, occupational exposures, exposure to mercury in indoor air has been assumed to be relatively minor. However, indoor air pollution is increasingly garnering attention in the United States, and a number of potential sources of mercury exist in residential settings that raise questions as to their significance (2). Elemental mercury (Hg⁰) is readily absorbed in the respiratory tract and can adversely affect the central nervous system resulting in symptoms including tremors, increased excitability, and delirium.

Unique to the heavy metals, Hg⁰ has a relatively high vapor pressure (~1.1 × 10⁻³ Torr at 20 °C), and the saturated atmosphere concentration (~12 mg m⁻³ at 20 °C) is almost 3 orders of magnitude greater than the time-weighted average threshold limit value (0.025 mg m⁻³) for occupational exposure (3, 4). Thus any source of Hg⁰ in a confined indoor

environment can result in airborne concentrations that raise significant health concerns. Despite the common use of mercury in household products, little research exists regarding the relevance of this potential source of indoor air pollution.

Common sources of mercury in residential settings can be separated into two loosely defined categories: materials that contain salts of mercury either as an intentional additive or an accidental contaminant and devices that contain free Hg⁰. Within this first category, indoor latex paints represent one of the most prominent examples of mercury sources. Phenylmercuric acetate and other mercury compounds were common additives in latex paints through the late 1980s because of their efficacy as fungicides and bactericides (5). To a lesser extent, contact lens solutions, nasal sprays, and other home medications have been manufactured with trace concentrations of phenylmercuric acetate or phenylmercuric nitrate to inhibit microbial growth. Mercury is commonly found as a contaminant in many alkali-based detergents and cleansers because of the extensive use of mercury electrodes in the chlor-alkali industry (6). Similarly, chlorine-based cleansers and household products may contain mercury as a contaminant. While these materials contain mercury salts, volatile Hg⁰ may be formed either during the manufacture of these materials or due to the decomposition of the compounds (7).

Free Hg⁰, because of its unique physical and chemical properties, has also been commonly used in a range of household devices. Among the most recognizable of these is the common mercury body temperature thermometer. Significant amounts of mercury are also used in fluorescent light bulbs, electrical tilt switches commonly used in household thermostats, float controls in sump pumps, barometers, and gas flow meters. These devices generally include mercury in a self-contained reservoir, unfortunately these containers are commonly made of glass and can be broken easily thus releasing the liquid metal into the residential environment. Mercury can adsorb onto a number of common household surfaces, thus preventing complete clean up and removal of the metal following an accidental spill (8).

A number of recent events highlight the potential significance of indoor mercury contamination. Increasingly, primary and secondary schools have reported unsafe conditions resulting from accidental spills of liquid mercury (9). The Nicor power company of Chicago is currently inspecting over 200 000 households because of suspect mercury spills resulting from the routine replacement of natural gas meters (10). Several municipalities, including Boston, San Francisco, and Duluth, have banned the sale of mercury thermometers altogether as a result of potential health risks, and the state of New York is currently considering proposed legislation to limit mercury use in all consumer products (11). Despite the significance of this prospective problem, little data exists on the potential for household products and devices to contaminate indoor air with Hg⁰. In an effort to examine the potential for mercury exposure in common living environments, we conducted sampling for indoor Hg⁰ in residential and business dwellings from June 2000 through March 2001.

Materials and Methods

Twelve indoor sites were selected to represent a cross-section of building types, locations, and ages in the New York metropolitan area. No information regarding a known or suspect contamination with mercury or mercury products was used in identifying these locations. Nine residential

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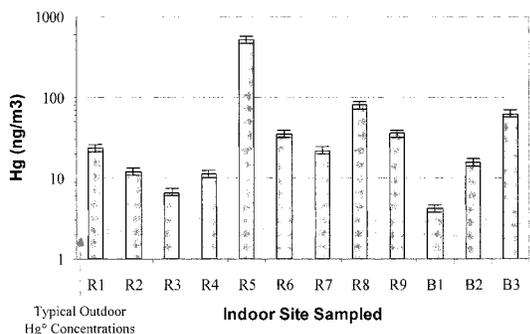


FIGURE 1. Indoor airborne Hg⁰ concentrations at 12 sites in the New York metropolitan area.

settings were chosen as follows: R1 is a studio apartment in a four-story, prewar building in mid-town Manhattan; R2 is a two-bedroom condominium in a high-rise, newly built apartment building in mid-town Manhattan; R3 is a studio apartment in a high-rise, prewar apartment building in mid-town Manhattan; R4 is a three-bedroom apartment in a high-rise, postwar building on the upper east side of Manhattan; R5 is a one-bedroom apartment in a high-rise, prewar building on the upper west side of Manhattan; R6 is a three-bedroom, two-story house in Forest Hills, Queens; R7 is a three-bedroom apartment in a four-story, postwar building in Flushing, Queens; R8 is a two-bedroom apartment in a turn-of-the-century brownstone in Park Slope, Brooklyn; and R9 is a four-bedroom, two-story, 80 year old house in western Connecticut. Three business environments were chosen as follows: B1 is a postwar, high-rise office building in mid-town Manhattan; B2 is a prewar, six-story building in mid-town Manhattan; and B3 is a postwar, four-story building in mid-town Manhattan that houses college classrooms and science laboratories. All mercury sampling was conducted at a height of approximately 1 m above the floor for a 3–5 h period in common areas of the living quarters or work settings (i.e. living rooms or hallways) with the windows closed.

Mercury vapor sampling was conducted continuously in 5-min intervals with a Tekran Model 2537A mobile Cold Vapor Atomic Fluorescence Spectrometer. The instrument has a detection limit of < 1 ng Hg⁰ m⁻³, and instrument calibrations were conducted using an internal mercury permeation source and an external standard injection source. Calibrations and zero-air blank analyses were conducted almost every day during the sampling period. Internal permeation source calibrations remained consistent over the entire duration of this research with the standard deviation of the calibrations equaling less than 2% of the mean and the 95% confidence interval of the calibrations equaling less than 0.5% of the mean calibration value. Blank analyses remained consistently low over the entire sampling period with a mean value of 0.14 ± 0.02 ng m⁻³ and a maximum of 0.72 ng m⁻³. Periodically, the instrument permeation source was calibrated using an external, mercury standard addition injection source. The internal and external calibration sources agreed closely with a mean difference between the calibrations of 4.7% ± 1.8%. As an additional measure of analytical accuracy, background outdoor Hg⁰ concentrations measured over the course of the sampling period (1.8–4.2 ng m⁻³) agreed closely with known, published background outdoor Hg⁰ concentrations (12).

Results

Figure 1 summarizes average indoor Hg⁰ concentrations at each of the 12 sampling sites. Indoor concentrations of Hg⁰ were significantly elevated over mean outdoor Hg⁰ levels at all except one of the locations sampled.

Indoor mercury concentrations were highly elevated over outdoor concentrations at sites R1, R5, R6, R7, R8, R9, B2, and B3, suggesting an indoor source of Hg⁰ existed at these locations. Table 1 summarizes site information and average indoor Hg⁰ concentrations at each of the sites monitored.

In an effort to identify possible sources of elevated Hg⁰ at the sites monitored, extensive interviewing and additional sampling was conducted at the indoor locations. Site B3 is a college building that houses classrooms and science laboratories. The concentrations reported at B3 occurred in a highly trafficked, public hallway at least 100 m from the nearest laboratory; however, it is likely that laboratory contamination contributes to the high Hg⁰ levels identified at this site. At site R5, the current tenant recalled breaking a mercury thermometer within the 6-month period prior to our sampling. The spill occurred on a tiled bathroom floor, and the tenant stated that the spill was cleaned up with paper towel. The tenant further inspected the floor with a magnifying glass, and all small droplets of mercury were removed using the adhesive side of masking tape. While these are not recommended cleanup methods for liquid Hg⁰, they were all that was available to the tenant at the time, and they likely represent the methods used in most households under similar circumstances. Airborne mercury sampling was conducted in the bedroom at this location, which is adjacent to the bathroom where the spill was identified. The highly elevated levels of Hg⁰ at this location (523 ± 6 ng m⁻³) suggest that residual mercury from the broken thermometer is a significant source of indoor air pollution. In an effort to confirm whether residual mercury in the bathroom was the source of elevated mercury at this residence, we applied a thin dusting of powdered sulfur to the floor of the bathroom. Powdered sulfur forms a film over metallic mercury, which reduces the emission of Hg⁰; the technique has been used extensively to treat mercury spills in industrial and commercial settings (13). Immediately following (<5 min) the application of sulfur to the floor, indoor mercury concentrations had dropped to 395 ± 32 ng m⁻³, significantly less than the average concentration measured prior to sulfur application.

At site R9, the tenant also recalled an accident with a mercury thermometer that led to a spill of liquid mercury. This spill occurred on a bathroom tile floor, and visible mercury was immediately removed using paper towel and disposed. When this bathroom was sealed off from the rest of the house, mercury concentrations inside of the bathroom measured 45.0 ± 0.7 ng m⁻³, and the average concentration in the remaining rooms of the house measured 7.6 ± 0.4 ng m⁻³, suggesting that residual mercury on the bathroom floor was the source of indoor contamination. While the date of the spill could not be determined exactly, the tenant estimated that the accident occurred between 1983 and 1985, more than 16 years prior to indoor sampling. It is probable that in the first years following the accident, indoor mercury concentrations were highly elevated over those reported here.

No history of mercury contamination could be identified by the current tenants of sites R1, R6, R7, R8, or B2. In an effort to discern a possible source of mercury at those residences for which no source was identified, we conducted extensive indoor sampling at residential site R8 in August and October 2000, the site with the second highest indoor Hg⁰ concentration. Site R8 is a four-room apartment in a 100-year-old brownstone in Park Slope, Brooklyn. The apartment is rectangle running east–west with the approximate dimensions of 20' × 60'. The living room and a small study occupy the east end of the apartment, and the master bedroom occupies the west end, separated by a 10-foot walk-thru kitchen.

Mercury sampling showed a statistically significant concentration gradient across the apartment. During our August

TABLE 1. Site and Measurement Data at the 12 Monitoring Sites

site	location	date	n	temp (°C)		[Hg ⁰] ng/m ³ ± 95% CI
				indoor	outdoor	
R1	Manhattan	7/11/00	24	26	26.1	23.91 ± 1.0
R2	Manhattan	7/17/00	45	22 ^a	24.4	12.14 ± 0.7
R3	Manhattan	9/11–9/15/00	1006	25.6	8.3	6.51 ± 0.1
R4	Manhattan	9/22/00	33	25.9	0	11.11 ± 0.2
R5	Manhattan	3/17/01	10	22 ^a	8.05	522.78 ± 6.1
R6	Queens	9/10/00	86	24.6	21.6	35.27 ± 0.6
R7	Queens	9/10/00	31	29	22.7	21.58 ± 0.8
R8	Brooklyn	8/9/00 ^b	107	24.4	27.5	81.15 ± 2.2 ^c
R9	Connecticut	1/27/01	77	25	-2.8	36.51 ± 1.1
B1	Manhattan	9/8/00	51	22.5	14.4	4.25 ± 0.3
B2	Manhattan	9/07/00	37	22.3	12.7	15.51 ± 0.6
B3	Manhattan	8/11–8/13/00	447	24 ^a	19.5	62.49 ± 1.1

^a Indoor temperature not available, estimate provided. ^b Site revisited on 10/15/00. ^c Concentration measured in the apartment study.

sampling regimen, airborne mercury averaged $81.1 \pm 2.5 \text{ ng m}^{-3}$ in the study located at the east end of the apartment yet only $50.1 \pm 1.4 \text{ ng m}^{-3}$ in the bedroom at the west end of the apartment. This skewed distribution of Hg⁰ suggested that a localized source of the mercury might exist at the east end of the apartment.

Site R8 was revisited for indoor sampling again in October 2000. Average indoor mercury concentrations in the apartment study in the fall, $40.3 \pm 0.3 \text{ ng m}^{-3}$, were significantly lower than those measured in late summer ($81.1 \pm 2.5 \text{ ng m}^{-3}$). Both summer and fall measurements were conducted with the apartment windows closed, and no effort had been made to clean the residence of mercury contamination in the interim. The change in indoor Hg⁰ concentrations was not correlated with a change in indoor temperature ($T_{\text{in(August)}} = 24.4 \text{ }^\circ\text{C}$, $T_{\text{in(October)}} = 25.3 \text{ }^\circ\text{C}$, $\Delta T_{\text{in}} = +0.9 \text{ }^\circ\text{C}$). In other published work that examined the possible cause of a drop in indoor Hg⁰ in an office building during a 7-day monitoring period, the only factor that proved significant was a drop in outdoor temperature (14). We also noted a significant drop in outdoor temperature between the two sampling periods ($\Delta T_{\text{out}} = -24.4 \text{ }^\circ\text{C}$). This phenomenon of seasonal changes in indoor mercury concentrations was also seen at other locations. At site R1, indoor mercury concentrations measured $23.91 \pm 1.0 \text{ ng m}^{-3}$ in July 2000 and $13.1 \pm 1.1 \text{ ng m}^{-3}$ in January 2001, during the same time period $\Delta T_{\text{in}} = -2 \text{ }^\circ\text{C}$ while $\Delta T_{\text{out}} = -17.2 \text{ }^\circ\text{C}$. At site B3, indoor Hg⁰ averaged $62.5 \pm 1.1 \text{ ng m}^{-3}$ in June 2000 and $5.18 \pm 0.1 \text{ ng m}^{-3}$ in January 2001 ($\Delta T_{\text{in}} = -1.9 \text{ }^\circ\text{C}$, $\Delta T_{\text{out}} = -26.1 \text{ }^\circ\text{C}$). While it is difficult to identify a determinant variable effecting seasonal changes in indoor Hg⁰, it is likely that increased atmospheric turbulence and greater indoor–outdoor temperature gradients in fall and winter cause an increase in the exchange of indoor air with fresh outdoor air thus diluting indoor Hg⁰ levels. During indoor sampling in this study, all residence windows and doors were closed (air conditioning was used as it would be normally), thus the variations in indoor levels of Hg⁰ were independent of this factor. Opening windows or doors results in a rapid (<5 min) equilibration of indoor Hg⁰ concentrations with those measured in outside air.

To further identify a source of airborne mercury at site R8, we conducted extensive Hg⁰ sampling using an open-bottom, polyethylene static surface chamber. The ~0.1 m² chamber was placed on the wooden floor surface in this residence and moved periodically, allowing it to equilibrate at each new location. Vapor-phase mercury concentrations in the chamber were then sampled through a small hole at the top. Figure 2 illustrates relative chamber mercury concentrations measured at ~1 m intervals across the floor in the study and living room of site R8.

Chamber mercury concentrations were highly elevated along a ~1 m² area of the floor near the northeast corner of

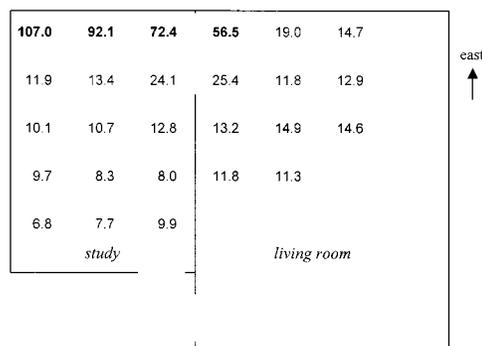


FIGURE 2. Hg⁰ concentrations (ng m⁻³) measured at ~1 m intervals in two rooms at site R8 using a surface chamber.

the apartment (bolded in Figure 2). No other areas of the apartment floor showed elevated chamber levels of Hg⁰. The data suggest that airborne mercury contamination at site R8 results from the surface emission of Hg⁰ from a small area of the wooden floor. To corroborate whether this surface contamination was responsible for elevated room Hg⁰ concentrations, a layer of powdered sulfur was applied to the area of the floor identified as having elevated mercury emissions. After the application of sulfur, indoor Hg⁰ concentrations at site R8 averaged $19.4 \pm 0.3 \text{ ng m}^{-3}$, significantly less than all measurements made prior to treatment.

The current residents at site R8 could not identify a source of mercury contamination during the past 3 years. While the exact source of mercury contamination at this site could not be identified, the limited size and distribution of the contaminated area as well as its identified location on the floor would suggest that it is likely related to a spill of mercury from a thermometer or other mercury-containing device more than 3 years prior to indoor sampling.

Discussion

Our data indicate that mercury released from household devices can contaminate indoor residential environments for decades following the first release of the metal. The U.S. Agency for Toxic Substances and Disease Registry (ATSDR) and the U.S. Environmental Protection Agency (EPA) have established reference concentrations for exposure to vapor-phase Hg⁰ of 200 and 300 ng m⁻³, respectively, based on evidence of increased hand tremor and other neurological dysfunction in occupationally exposed workers (15, 16). Airborne Hg⁰ concentrations at one of our 12 sampling concentrations (site R5) exceeded even the more liberal EPA reference concentration (RC). While our data set is limited, in another published study at least 10% of 39 randomly chosen

control households (those with no known source of airborne mercury) had indoor Hg^0 levels in excess of the EPA *R/C* (17). Our average indoor mercury concentration (69 ng m^{-3}) is notably similar to that reported in this earlier study (50 ng m^{-3}). This combined data may suggest that a significant number of households have indoor mercury pollution above the EPA *R/C* due to historical accidents with mercury-containing devices.

At the average concentrations of indoor Hg^0 reported in these studies ($50\text{--}69 \text{ ng m}^{-3}$), an adult female would be exposed to between 494 and 682 ng day^{-1} of mercury, and a young child (0–2 years) would be exposed to between 197 and 410 ng day^{-1} of mercury, given published exposure factors (adult female: $11.3 \text{ m}^3/\text{day}$ inhalation, 21 h/day indoors; child: $4.5 \text{ m}^3/\text{day}$ inhalation [0–1], $6.8 \text{ m}^3/\text{day}$ inhalation [1–2], 21 h/day indoors) (18). At the highest level of indoor Hg^0 measured in this study, an adult female would be exposed to approximately 5171 ng day^{-1} , and a child would be exposed to between 2059 and 3111 ng day^{-1} . At these levels, Hg^0 exposure in the home would rank second only to fish consumption ($2900\text{--}3270 \text{ ng day}^{-1}$) as a source of mercury intake in the general population, and this route may be even more significant than fish consumption in certain exposure scenarios (19, 20). If high levels of indoor Hg^0 are common in the general population, this exposure route may raise significant concerns regarding mercury health effects in young children. Current health risk assessments of mercury have not considered this pathway of exposure due to the lack of available data on household Hg^0 levels. Further research is essential to determine if indoor, airborne Hg^0 is a significant source of mercury exposure in the general population. Given the information we have presented on the effects of temperature and seasonality on indoor Hg^0 , future studies should examine the relationship between indoor Hg^0 and indoor/outdoor temperatures and barometric pressure at multiple locations over multiple seasons.

Our data suggest that indoor mercury concentrations show significant fluctuations over time that appear to be related to seasonal atmospheric changes. Unfortunately, a growing number of households and schools are currently undergoing indoor mercury monitoring campaigns due to high levels of mercury spilled from thermometers, gas meters, or other sources (21). These data indicate that short-term monitoring for indoor Hg^0 may not be sufficient to characterize the potential risks from indoor mercury spills, and multiseason monitoring should be considered to adequately characterize these potential exposure hazards. A recent *National Alert* issued by the U.S. ATSDR supports this conclusion by suggesting that short-term monitoring of indoor mercury contamination was not sufficient to assess the potential health risks in at least two incidents following the spill of Hg^0 in indoor environments (22).

Reasonable alternatives exist for most applications in which liquid mercury is used in consumer products. Many

municipalities are moving toward banning the sale of mercury thermometers and other household devices that contain mercury. Given the potential risks that we have identified from the potential release of Hg^0 from consumer products, this research calls into question the continued use of mercury in any household appliance or product.

Acknowledgments

Our most sincere thanks to those individuals who allowed us entry into their homes to conduct this study. Funding for this work was provided by the Research Foundation of the City University of New York (CUNY), the CUNY Professional Staff Congress, and John Jay College of Criminal Justice.

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ES010749P



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 2
290 BROADWAY
NEW YORK, NY 10007-1866

JUL 13 2010

Arnold P. Wendroff, Ph.D.
544 Eighth Street
Brooklyn, New York 11215-4201

Dear Dr. Wendroff:

Thank you for your correspondence of May 27, 2010 regarding ritualistic mercury use. As always, we appreciate your continuous interest, concern and involvement to raise awareness on issues concerning the ritualistic use of mercury. As was stated in previous communications with you, the EPA has worked well with others to raise awareness on the issue and take action within the current legal framework of our authorities. We will continue to do so in the future. EPA has an ongoing concern about potential mercury (Hg) exposure associated with its use in ritualistic practices. Conceivably, such exposures can even extend to non-users through a scenario where ritualistic Hg practices by previous occupants of residential dwellings have contaminated the living space of the current unsuspecting residents. EPA Region 2 is exploring ways to characterize this potential exposure scenario.

As part of our efforts to find a way to study potential mercury exposure associated with its use in ritualistic practices, we are pursuing the Regional Applied Research Effort (RARE) Program. The RARE Program is one approach EPA takes to promote collaboration between the Regions and EPA's Office of Research and Development (ORD). The goals of the program are to:

- 1) Provide the Regions with near-term research on high-priority, region-specific science needs,
- 2) Improve collaboration between Regions and ORD laboratories, and
- 3) Build a foundation for future scientific interaction.

ORD provides \$200,000 per year to each Region to develop a research topic, which is then submitted to a specific ORD laboratory or center as an extramural research proposal. Once approved, the research is conducted as a joint effort with ORD researchers and regional staff working together to meet region-specific needs.

RARE grants are competitively awarded so it's critically important to insure as sound and scientifically rigorous a proposal as possible. Due to the competitive nature of the RARE Program process, there is no guarantee that

any given proposal will be selected. Ultimately, the fate of a RARE proposal is governed by the rigor and regional importance of the study as judged by the members of the Regional Science Council and EPA's Senior Management Team. RARE grants follow a regimented time line - the deadline for the current submission is July 31, 2010. Region 2 is also in active discussion with our colleagues in Region 1 to identify ways in which we can work collaboratively on issues surrounding ritualistic use of mercury. We have discussed with them our draft RARE grant proposals (see below) and are exploring the possibility of a joint proposal.

Studying the prevalence of ritualistic Hg use and its potential for contaminating residential dwellings poses logistic challenges, both legal and cultural. Access agreements would be needed to gain entry into residential dwellings. EPA has explored accessing vacant NYC Housing Authority apartments as a way to obviate this requirement. Another approach would be to expand on a ritualistic Hg study that NJDEP performed in Union City, N.J., where building common spaces (hallways, vestibules, etc.) rather than apartments were sampled. However, getting to an apartment entrance and not beyond does limit the usefulness of the sampling data. Perhaps most promising is an ongoing children's health study being conducted at the Columbia University School of Public Health. The study, which has a sizable Dominican cohort, is primarily focused on asthma triggers and pesticides. Access agreements are already in place; thus, it may be possible to incorporate residential Hg vapor sampling into the study design, although there may be cultural sensitivity associated with sampling to identify ritualistic practices. Issues such as this need to be considered as part of a robust research proposal.

Thank you for your continued interest in public health intervention strategies related to ritualistic Hg use. For any follow-up queries on this issue, please contact Mark Maddaloni of my staff. Mark can be reached at (212) 637-3590 (maddaloni.mark@epa.gov).

Sincerely,



Judith A. Enck
Regional Administrator

**U.S. EPA / Region 2/Office of Research and Development
FY11 Regional Applied Research Effort Proposal**

PROJECT TITLE AND REGIONAL CONTACT: **Mercury Vapor Sampling in Targeted Housing: Investigation of Ritualistic Mercury Use.** Mark Maddaloni - Office of Strategic Programs, Office of the Regional Administrator (212) 637-3590

DIRECTOR'S NAME: Pat Evangelista - Director, Office of Strategic Programs (212) 637-4447

ORD CONTACT:
Matt Lobber - National Center for Environmental Assessment. (202) 564-3243 lorber.matt@epa.gov

PROJECT DESCRIPTION:

Science and Environmental Issues: Elemental mercury plays a role in several related Afro-Caribbean religions including Santeria (NJDEP, 2003). Such practices include the sprinkling of mercury in residential dwellings. Air monitoring data in the hallways of buildings in areas with a large Afro-Caribbean population in NJ have provided strong evidence that at least 2% of apartments in these areas have an ongoing or historic presence of mercury, consistent with such cultural use, that exceeds the background in non Afro-Caribbean areas (NJDEP, 2003; NJDEP, 2007). Such uses potentially pose a health hazard, not only to those who engage in these practices, but to subsequent occupants of these dwellings.

Research Objectives and Expected Outcomes: Despite knowledge of the existence of ritualistic practices involving mercury, no data exist on levels of in-dwelling exposure. A study conducted previously by NJDEP relied on indirect indicators outside apartments of conditions inside apartments and could not provide an estimate of the airborne concentration of mercury inside the apartments. **Measurement of mercury vapor inside a dwelling, at the point of exposure, is the best environmental indicator of potential hazard. This pilot level study of targeted housing will inform the potential extent and magnitude of mercury vapor contamination secondary to ritualistic practices by directly measuring mercury vapor concentration in targeted housing units.**

Approach: EPA Region 2 and the Office of Research and Development will collaborate with the NJDEP-Office of Science, the Hudson Regional Health Commission (HRHC), the NJ Dept. of Health and Senior Services (NJDHSS), the NJ Dept. of Community Affairs (NJDCOA) and UMDNJ (Dr. Michael Gochfeld, M.D., Ph.D.). The study tasks are as follows:

Sampling Design – EPA, NJDEP, NJDCOA and HRHC will coordinate to construct a sampling schedule for Union City/West New York, NJ that will coincide with NJDCOA's regular inspection of apartment buildings in those areas. Control apartments will be identified from inspections in non Afro-Caribbean communities.

Sampling – HRHC will accompany NJDCOA inspectors to apartments where real-time readings for mercury vapor will be conducted using a Lumex portable sampling device. NJDEP owns such a device, and HRHC has extensive experience with its use from the previously-referenced studies.

Response Plan – EPA, NJDHSS, NJDEP and UMDNJ will review the scientific medical literature to derive a graded response plan to be used in the event that above-background levels of mercury vapor are detected in an apartment.

Medical Follow-Up – In the event that a significant exposure is discovered in an occupied apartment, UMDNJ (Dr. Gochfeld) will conduct an initial medical evaluation to determine the need for medical follow-up.

Data Analysis/Report Preparation - In coordination with EPA, NJDEP will take the lead in conducting statistical analysis of the data and in preparation of a draft and final report. All collaborators will review and comment on the draft report.

Estimated Budget and Timetable: Expenses for this study are limited to the following areas:

Partial salaries for HRHC, UMDNJ personnel

Transportation for HRHC

Preparation/printing of educational materials

Possible incentives for occupants

Approximate budget for the study is \$40,000-50,000.

Study Duration

Given the estimate from the previously-referenced studies that approximately 2% of apartments in the target communities may have current or historical contamination from cultural uses of mercury, we anticipate the need to sample in 250-300 apartments in order to get a representative sample of mercury vapor exposure levels in impacted apartments.

The rate of inspection of apartments in this study is constrained by NJDCA's inspection schedule (as feasible, we will work with NJDCA to temporarily give precedence to inspections in Union City/West New York). Given these two considerations, we anticipate that the field portion of this study will extend over two years.

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NJDEP (2007). Cultural Uses of Mercury in New Jersey – Year 2 Mercury Vapor in Residential Buildings – Comparison of Communities That Use Mercury for Cultural Purposes with a Reference Community (<http://www.state.nj.us/dep/dsr/research/mercury-cultural-yr2.pdf>).



FEMA

FEB 16 2006

MEMORANDUM FOR: George W. Foresman
Under Secretary
Preparedness Directorate

FROM: R. David Paulison
Acting Director

A handwritten signature in black ink, appearing to read "R. David Paulison".

SUBJECT: Mercury Contamination

I am attaching a packet of information on potential mercury contamination that was sent to our Recovery Division by Dr. Arnold Wendroff of New York. As you can surmise from the information contained, Dr. Wendroff is very interested in this issue and has engaged the various branches of government at many levels and through different departments and agencies.

Dr. Wendroff's letter acknowledges the important role of other agencies in this area (EPA, and others) but has also been approaching DHS with his suggestions due to the potential of the problem he has described.

While I believe Dr. Wendroff's concerns and ideas merit consideration, I do not believe FEMA is the appropriate entry point for this information. Perhaps the Chief Medical Officer in your office, as well as the Research Directorate, could examine this issue further.

Thanks for your time and attention to this matter.

Attachment

cc: Science and Technology Office



FEMA

APR 14 2006

Mr. Arnold P. Wendroff, Ph.D.
544 Eighth Street
Brooklyn, NY 11215-4201

Dear Dr. Wendroff:

This is in response to your letter of December 22, 2005 and your subsequent letter to the Federal Emergency Management Agency (FEMA), Acting Director R. David Paulison with regard to the Mercury Poisoning Project.

In your conversations with FEMA staff, they reviewed with you FEMA authorities and how they are triggered under the Robert T. Stafford Disaster Assistance Act. Potential supplemental assistance from Stafford Act programs is based first on a request by the Governor of the affected State stipulating that the situation is beyond the capabilities of the State and local governments. If the President concurs in that assessment, he may then declare either an emergency or a major disaster for the affected State. This help cannot duplicate assistance already available under other appropriate Federal authorities. At this time, we have no pending requests on this matter.

FEMA no longer has a Preparedness Office. Its responsibilities and resources have been folded into the Office of Preparedness at the Department of Homeland Security (DHS). As you note in your letter, our staff has discussed this matter with you in the past at some length. Given the wealth of information you provided, we in turn provided this collected information to the DHS's Office of Preparedness on February 16, 2006 (copy enclosed). In addition, we copied the Department's Office of Research and Technology as well.

We appreciate the time and effort you have put into this work and trust this response is helpful to you.

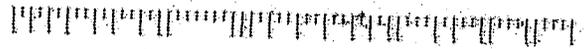
Sincerely,

A large, stylized handwritten signature in black ink, appearing to read "David Garratt".

David Garratt
Acting Director of Recovery Division
Federal Emergency Management Agency

Enclosure

11313149201-44 028



4-21-06
Rec'd.

Mr. Arnold P. Wendroff, Ph.D.
544 Eighth Street
Brooklyn, NY 11215-4201



FEMA

RE 0506
614-MAGAWAY

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Comparison of Indoor Mercury Vapor in Common Areas of Residential Buildings with Outdoor Levels in a Community Where Mercury Is Used for Cultural Purposes

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Elemental mercury has been imbued with magical properties for millennia, and various cultures use elemental mercury in a variety of superstitious and cultural practices, raising health concerns for users and residents in buildings where it is used. As a first step in assessing this phenomenon, we compared mercury vapor concentration in common areas of residential buildings versus outdoor air, in two New Jersey cities where mercury is available and is used in cultural practices. We measured mercury using a portable atomic absorption spectrometer capable of quantitative measurement from 2 ng/m³ mercury vapor. We evaluated the interior hallways in 34 multifamily buildings and the vestibule in an additional 33 buildings. Outdoor mercury vapor averaged 5 ng/m³; indoor mercury was significantly higher (mean 25 ng/m³; $p < 0.001$); 21% of buildings had mean mercury vapor concentration in hallways that exceeded the 95th percentile of outdoor mercury vapor concentration (17 ng/m³), whereas 35% of buildings had a maximum mercury vapor concentration that exceeded the 95th percentile of outdoor mercury concentration. The highest indoor average mercury vapor concentration was 299 ng/m³, and the maximum point concentration was 2,022 ng/m³. In some instances, we were able to locate the source, but we could not specifically attribute the elevated levels of mercury vapor to cultural use or other specific mercury releases. However, these findings provide sufficient evidence of indoor mercury source(s) to warrant further investigation. **Key words:** cultural use of mercury, elemental mercury, indoor air quality, mercury, mercury exposure, mercury vapor, Santeria, voodoo. *Environ Health Perspect* 114:59–62 (2006). doi:10.1289/ehp.8410 available via <http://dx.doi.org/> [Online 20 September 2005]

Mercury is one of two elements that are liquid at ambient temperature. It is 13 times heavier than water, and its unique properties have led to a wide variety of uses in industry and elsewhere. Elemental mercury is still widely used in dentistry and a variety of hospital applications (Haas et al. 2003). It is also found in a number of technologic applications such as thermometers, barometers, thermostats, switches, gas meters, and especially fluorescent lights that may be found in residential buildings. In the past, organic mercury compounds were widely used as preservatives in household paints, and mercury antiseptics are still in use.

The unique properties of elemental mercury or quicksilver have led people to attribute magical and spiritual powers to it through the ages. Mercury was viewed as an essential component of the alchemical triad of mercury, sulfur, and air and has been associated with the Hindu god Shiva (Little 1997). Mercury amalgam religious icons remain available today (Garetano G, unpublished data). Elemental mercury is also used in the spiritual practices associated with Santeria, voodoo, Espiritismo, Palo Mayumbo, and other Afro-Caribbean syncretic religions [Riley et al. 2001; U.S. Environmental Protection Agency (EPA) 2002]. Additional

uses of elemental mercury in a superstitious manner have been reported (Wendroff 1990). These practices include sprinkling elemental mercury in the home, in cars, or around babies and carrying capsules of mercury as amulets to bring good luck or love (Johnson 1999; U.S. EPA 2002). These activities do not appear to be components of ceremonial use associated with spiritual traditions, nor are they condoned or recommended by serious practitioners of those traditions (Stern et al. 2003). We label these uses of mercury, separate from the ceremonial use in spiritual traditions, as cultural uses. In communities where cultural uses of mercury are believed to be prevalent, the availability of mercury in specialty shops called botanicas has been well documented (Riley et al. 2001; Wendroff 1990; Zayas and Ozuah 1996).

Both the technologic applications and cultural uses of mercury provide the opportunity for it to be an indoor air pollutant in residential settings. Elemental mercury evaporates at a rate of 7 µg/cm²/hr at 20°C (Andren and Nriagu 1979). Up to 80% of inhaled mercury is absorbed and readily crosses the blood–brain barrier (Cherian et al. 1978; Clarkson 2002). The primary health concern associated with inhaled mercury vapor is its neurotoxicity, and infants are considered particularly

vulnerable. The Agency for Toxic Substances and Disease Registry (ATSDR) and the U.S. EPA, respectively, have established a minimal risk level (MRL) of 300 ng/m³ and a reference concentration (RfC) of 200 ng/m³ for elemental mercury vapor in residential quarters (ATSDR 1999; U.S. EPA 1995). The release of elemental mercury in a household may pose some health risk for those who are exposed. For example, broken clinical thermometers typically contain only 600–675 mg elemental mercury but can generate mercury vapor concentrations an order of magnitude above both the U.S. EPA RfC and the ATSDR MRL (Carpi and Chen 2001; Muhlendahl 1990; Riley et al. 2001; Smart 1986). Health effects in children have been documented from such exposures (Moreno-Ramírez et al. 2004).

By comparison, elemental mercury for cultural use is commonly distributed in gelatin capsules containing approximately 9 g elemental mercury (Riley et al. 2001; Wendroff 1990), which, when released, can result in high concentrations of vapor (Riley et al. 2001; U.S. EPA 1993). At least one case of significant human exposure to elemental mercury requiring medical intervention as a result of cultural practices has been reported (Forman et al. 2000).

Once spilled, sprinkled, or left in an open container, elemental mercury may release vapor for prolonged periods. Significant levels of mercury vapor have been found in buildings decades after spillage, resulting in the significant exposure of subsequent building

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occupants without their knowledge (Centers for Disease Control and Prevention 1996; Orloff et al. 1997).

Other than those investigations conducted in response to known spills, data regarding mercury vapor concentration in residential buildings are scant. Carpi and Chen (2001) surveyed 12 residential and commercial sites in the New York metropolitan area without prior knowledge of mercury contamination. Eleven of these locations were found to have mercury vapor concentrations significantly elevated over outdoor concentrations. Prior breakage of clinical fever thermometers was subsequently identified as the probable mercury source in two of the locations.

Given the lack of documentation of mercury vapor in residential buildings in general or of a disproportionate elevation of mercury vapor in buildings in communities where it is used culturally, we chose to conduct a survey of residential dwellings in a community in which elemental mercury is readily available to assess the prevalence of mercury use or spillage.

We hypothesized that elevated levels of mercury vapor would be found in residential buildings in communities that engage in cultural uses of mercury. We further hypothesized that these elevated levels can serve as a signal of significant cultural use in addition to unintentional breakage and spillage from other sources. In this article we address the first hypothesis. We address the second hypothesis in a subsequent study to be published separately.

Materials and Methods

Rationale for this study design. Riley et al. (2001) described a high level of apprehension and distrust of authorities or any outsider from a different culture. As a result of these cultural barriers, direct investigation of the residences of persons possibly using mercury for cultural purposes without first establishing a cause for concern was deemed inappropriate. Therefore, as a first step in characterizing the extent of this phenomenon, we chose to monitor mercury vapor within interior hallways of residential buildings, rather than directly measuring mercury vapor in residences, under the assumption that intentional and unintentional releases of mercury within the building would be reflected in elevated concentrations in common areas compared with the respective outdoor concentrations. Measurement of mercury vapor in common areas does not provide a direct estimate of exposure, but by comparing these measurements with respective outdoor levels and by comparing measurements across buildings, we can assess the prevalence of elevated indoor mercury concentrations. This information can

inform decisions about appropriate public health strategies and can guide future surveys.

Site selection. The information on cultural uses of mercury suggests that such uses are most common among certain Latino-Caribbean populations. The geographic area selected for inquiry was based on our prior knowledge of both the predominant Latino population and the presence of botanicas that typically sell mercury (Riley et al. 2001; Stern et al. 2003). The study was conducted in the New Jersey municipalities of Union City and West New York, comprising a total area of approximately 2.4 mi² (6.2 km²), with 82.3 and 78.7% Latino population, respectively. Multifamily buildings were chosen for accessibility of common areas as well as for the potential for efficient screening. A primary criterion was that the buildings surveyed be within 0.5 miles (0.8 km) of a botanica. On the initial sampling date, a building meeting this criterion was selected on referral from a local health official, and all accessible buildings for approximately a two-block radius were evaluated. On subsequent sampling dates the same procedure was followed in other areas of the community meeting the same criteria. Additionally, three botanicas and one former botanica encountered during the residential building surveys were also visited.

Mercury vapor monitoring. We measured real-time mercury vapor concentration in air using an atomic absorption spectrometer (model 915+; Ohio Lumex Co. Inc., Twinsburg, OH). The instrument has a sensitivity of 2 ng/m³ of mercury in air and has been successfully used for measuring mercury in ambient air (Ohio Lumex 2000; Zdravko and Mashyanov 2000). In previous studies, residential structures identified as having elevated mercury concentration with such direct reading instruments were also found to have elevated mercury vapor concentration with 8-hr sampling and subsequent laboratory analysis (Singhvi et al. 2001).

The instrument was factory calibrated according to the manufacturer's specification and was within its factory calibration schedule. The spectrometer warmup, operation, and calibration followed the manufacturer's instructions. Internal calibration uses a built-in mercury cell and was performed in the field before and on completion of sampling in typical field conditions. During internal calibration, measured mercury concentration varied from the predicted concentration by < 10% on each date. We validated precision by evaluating the relative deviation of triplicate measurements at each sampling location. The overall relative deviation for the 286 triplicate sample sets that were equal to or exceeding the manufacturers' stated detection limit of 2 ng/m³ mercury vapor was 7.9%.

Once the instrument was warmed up and calibrated, it was operated continuously. All measurements were recorded at a height of approximately 1 m above the floor unless otherwise indicated. Each data point is the average of three discrete 10-sec measurements at a given sampling location. The instrument also displayed mercury concentration continuously in a real-time sampling mode. This allowed evaluation of spatial variation and trends in mercury vapor concentration. Potential sources were localized where possible.

Site visits were conducted on 6 days in June and August 2002. Although only one visit was planned for each site, repeat visits were made to two buildings because of the high mercury vapor concentration encountered. Mercury vapor was monitored in the vestibule and the interior hallways on each floor of the buildings. These interior hallways contain the entrances to residential apartments. About half the buildings surveyed had open access to both locations. A total of 227 locations in 67 buildings were surveyed. On average, five hallway locations were assessed in those buildings that were fully accessible. All buildings were visited once except the two buildings with the highest readings. Mercury vapor measurements were recorded in 37 outdoor locations in proximity to the buildings evaluated. Outdoor readings near neighboring buildings showed low variation. Within the three botanicas and one former botanica, mercury vapor was monitored in the retail portion of the store.

Additional data. In addition to mercury vapor measurements, the following data were also collected for each building: number of residential units, number of floors, presence of a central heating ventilation and air conditioning system (HVAC), and the presence of open windows.

Data analysis. We calculated the mean mercury vapor concentration for each floor of a building by averaging all data points for that floor. We computed the average mercury concentration for a building by averaging the mean concentration for each floor. The maximum mercury vapor concentration reported for a building is the maximum data point from any hallway location within the building. Statistical analysis was conducted using SPSS software (SPSS Inc., Chicago, IL). Specific tests are indicated in the results section as applicable.

Results

Site access and characteristics. Sixty-seven buildings were visited, of which approximately half were fully accessible. Only vestibules were accessible in the remainder. All buildings in which the interior halls were accessed ($n = 34$) were multistory (mean, 4 floors) with a total of 497 residential units

(mean, 14 units). Buildings in which only the vestibule was accessible tended to be slightly smaller (mean, 12 units), although this difference was not significant ($p = 0.18$). Based on familiarity with the area, including community history, overall appearance, and census characteristics, all buildings are believed to be > 50 years old, although records were not uniformly available. None of the buildings had HVAC systems that influenced the areas evaluated. Ventilation within the hallways was primarily influenced by windows and doors to residential apartments; 12 of 34 (35%) buildings had open hallway windows during the time of the visit.

Mercury vapor concentration. The data were log-normally distributed; thus, arithmetic and geometric mean values, as well as percentiles, are reported. Because of relatively limited sample size and non-normal distributions, we compared mercury values using the Mann-Whitney U -test as well as by t -test on log-transformed data, unless otherwise indicated.

Outdoor mercury vapor concentrations had a mean value of 5 ng/m³ with an 80th percentile of 12 ng/m³ and a 95th percentile of 17 ng/m³. Our findings are consistent with outdoor levels measured elsewhere ranging from several nanograms per cubic meter to 20 ng/m³, with higher concentrations associated with urban/industrial areas and ambient mercury outside a mercury storage facility in Hillsborough, New Jersey, ranging from 2 to 8 ng/m³ (ATSDR 1999; Gochfeld M, unpublished data; New Jersey Department of Environmental Protection 2001).

The geometric and arithmetic mean mercury concentrations in building hallways were 10 ng/m³ and 25 ng/m³, respectively. In building vestibules, the geometric and arithmetic means were 7 ng/m³ and 11 ng/m³, respectively. The mercury vapor concentration in interior hallways was significantly greater than that found outdoors ($p < 0.001$) and in building vestibules ($p < 0.05$). Mercury vapor in vestibules was also greater than that found outdoors ($p < 0.001$). All three locations were found to differ significantly ($p < 0.001$) when compared simultaneously using the Kruskal-Wallis nonparametric one-way analysis of variance test. Indoor and outdoor mercury vapor concentrations are summarized in Tables 1 and 2.

We found that 7 of 34 (21%) buildings had a mean mercury vapor concentration in hallways that exceeded the upper 95th percentile of outdoor mercury vapor concentration (17 ng/m³), and that 35% of buildings (12 of 34) had maximum mercury vapor concentration in hallways that exceeded the upper 95th percentile of outdoor mercury vapor concentration.

No significant difference was noted in the mean and maximum mercury vapor

concentration in buildings that had open windows compared with those that had either no windows or closed windows ($p < 0.8$ and $p < 0.4$, respectively). No difference was noted between mercury vapor concentration by measurement date using Kruskal-Wallis Test ($p > 0.6$) nor among the floors of the building on which the maximum concentration of mercury was detected ($p > 0.7$).

Within the three botanicas surveyed, average mercury concentration ranged from 40 ng/m³ to 482 ng/m³ (mean, 220 ng/m³), whereas a former botanica averaged 72 ng/m³. Mercury concentration within the botanicas was significantly greater than that within the residential buildings ($p < 0.01$).

Spatial variability. We were able to localize potential sources of mercury contamination in seven buildings as evidenced by increasing mercury concentration as the "source area" was approached. At two sites, the probable source of mercury vapor emission was tracked to areas on the floor surface, one near a building entrance, the second on a stairway to a roof exit. In the remaining five buildings, mercury vapor concentration increased as certain individual or groups of apartment entrances were approached. No visible contamination was noted in any of the cases, and the actual source of vapor remained unknown.

We noted order of magnitude differences in mercury concentration between locations in buildings with high mercury concentration. For example, mercury vapor concentration ranged from 35 ng/m³ to 2,022 ng/m³ in the building with the highest concentration. Similar findings were noted elsewhere. The difference between mercury concentration on the building level (floor) on which the maximal value was noted and the remainder of the building was significantly higher in four of the buildings ($p < 0.04$).

Temporal variability. Although our intent was to survey buildings once, two buildings had maximum hallway mercury vapor concentrations of 2,022 ng/m³ and 774 ng/m³, which exceeded both the ATSDR MRL (300 ng/m³) and U.S. EPA RfC (200 ng/m³).

Local public health officials were notified, and repeat visits were made to each building. The building with the highest concentration was visited on five dates. Both the average and maximum mercury vapor concentrations of the building were significantly different on repeat visits (Kruskal-Wallis test, $p < 0.04$). Outdoor temperature ranged from 17 to 31°C, and hallway windows were open, providing passive ventilation, on all dates. The building hallways were not cooled, and indoor temperature was similar to that outdoors. Unexpectedly, mercury vapor concentration did not vary as a result of temperature changes ($p > 0.7$), and contrary to expectation, higher mercury vapor concentrations were noted on cooler days. By the final visit, maximum mercury vapor concentrations in each building (109 and 19 ng/m³, respectively) were significantly reduced ($p < 0.01$) compared with the initial visit. In both buildings, mean and maximum mercury concentrations fell below MRL and RfC. Despite the reduction in vapor concentration, the area of maximum concentration remained consistent.

Discussion

Our findings provide a valuable first look at the differences between indoor mercury concentrations and those outdoors in an area with known cultural use of mercury. Although our data are not intended as estimates of residential exposure to mercury vapor, they do indicate that, compared with outdoor levels, such exposures are likely in a significant proportion of multifamily residential buildings in an area with known cultural uses of mercury. This study did not include comparison with indoor mercury concentrations in a comparable area that can serve as a control for cultural use of mercury. Therefore, these data cannot distinguish between those elevations in mercury concentration resulting from cultural uses and those resulting from unintentional releases of mercury (e.g., broken thermometers or fluorescent lightbulbs, spilled gas meter seals). We are currently engaged in a follow-up study to investigate these questions.

Table 1. Comparison of mercury vapor concentration (ng/m³) within building hallways and outdoors.

Location	No.	Arithmetic mean \pm SD	Geometric mean (SD)
Outdoors	37	5 \pm 5	4 (2)
Building vestibule	57	11 \pm 12	7 (2)
Mean in building hallways	34	25 \pm 53	10 (4)
Maximum in building hallways	34	102 \pm 364	17 (4)

Mann-Whitney U -test, $p < 0.001$.

Table 2. Distribution of mercury vapor concentration (ng/m³) within building hallways and outdoors.

Location	Percentile				
	25th	50th	75th	90th	95th
Outdoors	3	4	6	12	17
Building vestibules	4	7	13	22	36
Mean of building hallways	6	11	16	66	155
Maximum within hallways	9	14	25	106	1,086

There are relatively few reports of “background” mercury concentration in indoor air in residential buildings or “noncontaminated” environments to which our results can be compared. Our finding of mercury vapor in greater concentrations indoors compared with outdoors is consistent with the findings of Carpi and Chen (2001), who investigated mercury in residences without prior knowledge of mercury use or release.

Carpi and Chen (2001), using a direct reading instrument, were able to identify specific points inside several of the apartments they investigated that appeared to be the source of mercury emissions. Likewise, we were able to localize potential mercury sources in several buildings with elevated mercury concentrations. We clearly observed an increasing gradient in mercury vapor concentration as a potential source was approached. Although the exact source was not identified, the potential source of mercury vapor seemed to be residential apartments in five of the buildings with elevated mercury vapor concentration. Our finding that > 20% of buildings we studied had average and 35% had maximum mercury vapor concentrations that exceed the 95th percentile of outdoor concentrations is significant and leads to the conclusion that sources of contamination are present and prevalent indoors in this community. These findings are consistent with the hypothesis of cultural use of mercury, but not definitive. The elevated mercury vapor concentration found in botanicas is also consistent with its availability for cultural use.

These measurements were not made in areas that directly reflect exposure, nor, for the most part, do they measure concentration at the emission source. Therefore, these measurements could underestimate mercury concentration at the point of long-term exposure. Our surveys were subject to the variability in environmental conditions that occurs in occupied residential buildings and possibly the variability in patterns and methods of cultural mercury use. In most buildings surveyed, including those with the highest mercury vapor concentration, windows were open. This may partially explain the variability in mercury concentration and the lack of association with temperature we found in the sites with repeated visits. Although spot measurements of mercury vapor concentration in buildings may not reflect long-term average mercury concentration, we believe that the

signals of elevated mercury concentration provided by spot measurements are relevant as a screening tool in identifying the presence of mercury release regardless of its source. For this approach to be more effective as a tool for screening for exposures of concern, models need to be developed that can reasonably predict the transit of mercury vapor from a source “behind closed doors” to other rooms or areas of a building under conditions that simulate occupancy.

Whether exposure to elevated mercury vapor arises from intentional cultural uses or from unintentional breakage and spillage of mercury-containing equipment, these exposures pose the potential for adverse health effects and should be addressed. However, the nature and scope of the public health problem will be significantly different for each of these cases. Each will require a different public health outreach and intervention strategy. It is therefore essential that future investigations clarify the relative contribution of each cause. We are currently continuing research to this end.

Given the findings of Carpi and Chen (2001) and this investigation, we feel some broader evaluations to establish reference ranges of mercury concentrations in the indoor residential environment are warranted. Such a reference range would include mercury contamination resulting from historical accidental breakage of mercury-containing equipment. Such contamination may be widespread and would likely be independent of cultural factors. Based on reports on the manner in which mercury may be used for cultural purposes, and our present findings, we also recommend expanded screenings in areas where mercury may be used for cultural purposes with the inclusion of suitable control locations. Although cultural obstacles may be present that may impede a direct approach to assessing human exposure to mercury vapor as a result of cultural practices and its relevance to public health, we believe further evaluations in the field will ultimately shed light on this elusive issue.

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AN EVALUATION OF POTENTIAL EXPOSURE TO MERCURY IN A COMMUNITY [Union City & West New York, NJ] WHERE MERCURY IS USED FOR CULTURAL PURPOSES

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ABSTRACT OF THE DISSERTATION

Elemental mercury is used in a variety of superstitious and cultural practices. These practices involve **intentional dispersal of mercury within residential buildings** by individuals who believe this will provide some benefit or ward off harm but may represent **an insidious source of mercury exposure**.

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We determined that cultural mercury use is a likely source of exposure for a small but noteworthy percentage of individuals in communities where there is such use.

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Chapter 1

Comparison of Outdoor Mercury Vapor Levels to Levels in Common Areas of Residential Buildings in a Community where Mercury is used for Cultural Purposes

10

We hypothesize that elevated levels of mercury vapor are present in residential buildings in communities that engage in cultural use of mercury compared with outdoors. We further hypothesize that elevated levels can serve as a signal of significant cultural use in addition to unintentional breakage and spillage from other sources.

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Windows and doors to residential apartments primarily influenced ventilation within the hallways. **12 of 34 (35%) buildings had open hallway windows during the time of the visit.**

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Mercury concentration within the botanicas was significantly higher than that within the residential buildings ($P < 0.01$).

In the remaining five buildings, mercury vapor concentration increased as certain individual or groups of apartment entrances were approached. No visible contamination was noted in any of the cases and the actual source of vapor remained unknown.

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Although our data are not intended as estimates of residential exposure to mercury vapor they do indicate that, compared with outdoor levels, such exposures are likely in a significant proportion of multifamily residential buildings in an area with known cultural uses of mercury.

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Though the exact source was not identified, **the potential source of mercury vapor seemed to be residential apartments** in five of the buildings with elevated mercury vapor concentration. ... Our... findings are consistent with the hypothesis of cultural uses of mercury, but not definitive. **The elevated mercury vapor concentration found in botanicas is also consistent with its availability for cultural use.**

These measurements were not made in areas that directly reflect exposure, nor, for the most part, do they measure concentration at the emission source. Therefore, **these measurements could underestimate mercury concentration at the point of long-term exposure.** ... In most buildings surveyed, including those with the highest mercury vapor concentration, windows were open.

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Whether exposure to elevated mercury vapor arises from intentional cultural uses or from unintentional breakage and spillage of mercury-containing equipment, **these exposures pose the potential for adverse health effects and should be addressed.**

Based on reports on the manner in which mercury may be used for cultural purposes, and our present findings, **we also recommend expanded screenings in areas where mercury may be used for cultural purposes** with the inclusion of suitable control locations.

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Chapter 2

Comparison of Mercury Vapor in Residential Communities that use Mercury for Cultural Purposes with a Reference Community

After controlling for a number of factors that might influence Hg⁰ vapor levels, **the most plausible explanation for greater Hg⁰ vapor levels in the study area is cultural use of mercury.**

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Extensive detail exists elsewhere on the prevalence, manner of use and availability of Hg⁰ for cultural purposes (Johnson 1999; Johnson 2004; Ozuah et al. 2003; Riley et al. 2001; Stern et al. 2003; Wendroff 1990; Zayas and Ozuah 1996). Though mercury is available in communities where it is culturally, due to apprehension, a distrust of authorities and those outside the culture, it's sale or distribution to these "outsiders" is limited (Riley et al. 2001; Stern et al. 2003). This is not the case outside the U.S. where we readily purchased several grams of Hg⁰ and other select liquids and received verbal instructions on the most auspicious days to spread them on the floor in the home with the recommendation to do so twice-weekly (see figure 1).

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Although the magnitude of exposure to Hg⁰ vapor from cultural use is unknown, **the hazard of Hg⁰ vapor is well established and it is detectable years after small spills** from objects such as a fever thermometer (Carpi and Chen 2001; von Muhlendahl 1990). With larger spills, significant concentrations of Hg⁰ vapor may persist for decades (Sasso et al. 1996). **This presents the specter of exposure to Hg⁰ in residences from either unintentional or intentional Hg⁰ releases without knowledge of such**

exposure. Wendroff (2005) contends cultural mercury use has created such a problem. Based on the described manner and frequency of mercury use by some individuals this contention is not without basis.

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We cannot attribute the greater prevalence of elevated mercury vapor levels in this area or in the primary study community to cultural use with absolute certainty, but **we have no alternate explanation.**

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Our method relies upon sensitive instrumentation to detect a signal of mercury release though the source may be distant. Thus, Hg⁰ vapor exposure near the source in apartments is likely to be significantly greater than we detected in common areas, unless as we noted on occasion, the source was in the common area.

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When we examine these data in context with the prior literature, previous and ongoing biomonitoring programs, **there is no choice other than to acknowledge some percentage of individuals are needlessly and possibly unknowingly exposed to Hg⁰ vapor because of the cultural or folk use of mercury. This includes residents of apartments where mercury was used culturally by prior residents.**

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Chapter 3

Evaluation of Urinary Mercury as a Biomarker of Exposure for Individuals Exposed to Mercury Vapor in a Non-occupational Setting

62-63

While noting sub-clinical neurological findings from low-level Hg⁰ vapor exposure, Heyer et al. (2004) put forth the supposition, *“It is possible that elemental mercury may follow the history of lead, eventually being considered a neurotoxin at extremely low levels.”*

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We have demonstrated that the utilization of the value, 20µg/L, as the upper limit of normal urine mercury fails to identify significant exposure. All individuals in the lowest Hg⁰ vapor exposure category were exposed to Hg⁰ vapor at a level of magnitude above the U.S. EPA RfC (U.S. EPA 1995) and the ATSDR MRL (ATSDR 1999), yet two-thirds had urine Hg less than 20µg/L. If individuals in this group were the first to seek urine mercury screening, significant exposure might have been undetected. Thus, for this reason and those stated in the text, **we feel strongly that the value, 20µg/L, and the word “normal” should only appear together in a historical context.**

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Chapter 4

Conclusions and Recommendations

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The detection of elevated Hg⁰ vapor levels in residential buildings and botanicas supports the contention that mercury is available and released in residential buildings by cultural use.

However, the selection of reference buildings controlled factors likely to contribute to elevated Hg⁰ vapor levels leaving **cultural mercury use as the plausible explanation** for the difference in Hg⁰ vapor levels between the control and reference communities.

In summary we conclude:

1. **Hg⁰ vapor levels in the common areas of residential buildings in communities that use mercury for cultural purposes are significantly greater than those outdoors.**
2. **Hg⁰ vapor levels are significantly greater in the common areas of residential buildings in communities that use mercury for cultural purposes compared to those in communities where the use of Hg⁰ is unlikely.**
3. **Hg⁰ vapor exposure from cultural mercury use is likely in a small but noteworthy percentage of households in the study area.**
4. Biomonitoring of urine mercury is [a] reasonable tool to assess intermediate and chronic duration non-occupational exposure to Hg⁰ vapor, including that from cultural use, though at present, its sensitivity to detect exposure at less than 3µg/m³ Hg⁰ is unclear.

Recommendations for Public Health Action

The prevalence of cultural mercury use and the likelihood of exposure to Hg⁰ vapor at levels of public health concern warrant specific actions to address this use in communities where this practice exists. Though the extent of public health action might vary based on the prevalence of cultural use and associated Hg⁰ exposure, the following recommendations are relevant to the study communities surveyed in this research.

1. Culturally appropriate educational outreach activities, using written materials or other media that addresses sources of mercury, its health hazards, and resources for individuals who may be exposed are required. Educational materials must be accessible to individuals without deliberate action to seek information regarding mercury.
2. **Health care providers should be provided with educational materials and guidance regarding biomonitoring.**
3. **Public health clinics and appropriate community-based clinics should provide urine mercury screening to those individuals that reasonably believe they are exposed, regardless of their ability to pay for this analysis.**
4. **Local public health officials should have the capability, individually or regionally, to conduct mercury vapor monitoring with sensitive instruments. Monitoring in residences should be offered to all individuals with urine mercury above population norms. Public health officials should consider monitoring in all residences that request it.**

5. Recommendations 1 through 4 should be designed and implemented in a manner that allows

evaluation of their efficacy and relevance to other communities.

6. **A strategy should be developed by state and local public health and environmental officials, in consultation with federal officials, to guide response actions if residences with mercury vapor at levels of concern are identified.**

Recommendations for Additional Research

Research needs in addition to those that might accompany the recommended public health actions are also present.

1. **In other communities where there is cultural mercury use, air-monitoring surveys similar to that in Chapter 2 may be useful where deliberate public health action is deferred due to a lack of information regarding the prevalence of these practices.**
2. Studies to establish baseline levels of mercury vapor in residential buildings are warranted both to evaluate the contribution of indoor mercury vapor to total mercury exposure and to provide a basis of comparison for public health investigations involving indoor mercury vapor exposure.
3. The existing literature should be evaluated with consideration of the contribution of dental amalgam to urine mercury, to better describe the “normal” ranges of urine mercury in non-occupationally exposed populations.

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4. The effect of adjustment on urine mercury should be further evaluated in an attempt to aid interpretation of results and to foster consistency in reporting so that inter-study and inter-individual comparisons may be more relevant.

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Appendix A

Determination of the Number of Households in the Study Area that Might Contain Elemental Mercury in Sufficient Quantity to Generate a Signal of Mercury in Common Areas of the Residence

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By extrapolation, 1.74% of households (95% CI: 1.05%, 2.43%) or 689 (CI: 416, 962) of the 39,591 within the study area may contain mercury at a level sufficient to result in a Hg⁰ vapor signal of greater than 25 ng/m³ in building common areas. On average, there are 2.8 persons per household in this community.

Conclusion

The majority of households in the study area are not likely to contain Hg⁰ in sufficient quantity to generate Hg⁰ vapor signals of greater than 25 ng/m³ in common areas. Despite this, **the number of individuals in households where Hg⁰ is present at this level is of concern.**

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Curriculum Vita

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Mercury Hazard Widespread in Magico-Religious Practices in U.S.

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People of Hispanic and Caribbean ethnicity use metallic mercury to ward off evil spirits by ingesting it, applying it to the skin, and wearing it in an amulet

BY MICHAEL I. GREENBERG, MD, MPH

I recently attended an extremely interesting scientific conference organized by the Southern States Mercury Task Force. This group of environmentalists, toxicologists, and scientists meet annually primarily to discuss the mercury hazard in many bodies of fresh water in the United States.

The conference was absolutely fascinating on this subject, and covered many aspects of potential health hazards for humans posed by mercury in marine animals and marine food sources. While the conference concentrated on this aspect of environmental science, I became sidetracked by an engrossing lecture delivered by Arnold P. Wendroff, PhD, a research associate at Brooklyn College in Brooklyn, NY.

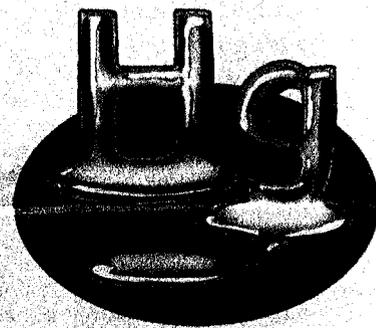
Dr. Wendroff is a social scientist who was a career elementary school teacher in the New York City school system, working in a

facility primarily attended by Hispanic students. Dr. Wendroff said one day during a lesson about the periodic table, one young Hispanic student indicated that he was familiar with the symbol for mercury.

Dr. Wendroff asked the student if he knew mercury was used for, fully expecting him to say that mercury was used in thermometers. The student responded that his mother used mercury to ward

off evil spirits. This simple answer thrust Dr. Wendroff into the strange and unusual world of magico-religious practices and ceremonies and their associated potentially hazardous exposures. Because the student's answer baffled Dr. Wendroff, he asked the child to bring him some of the mercury, and the child complied. Dr. Wendroff began a local investigation that led to a most fascinating and important public health/toxicology discovery that I will describe in this special report.

For Sale in 'Yerberias'
Elemental mercury — "azogue" as it is



known in the Hispanic community or "vi dajan" in the Haitian community — is commonly found for sale over-the-counter in stores known as "botanicas" or "yerberias." These botanicas and yerberias are small, privately owned specialty shops, located primarily in Latino and U.S.-Caribbean communities, that stock and sell popular religious items as well as many items that are thought to provide healing/medicinal benefits. Within the Latino and Caribbean communities, some people practice ethno-religious rituals that are part of what is known as Santeria, Espiritismo, or Voodoo. Azogue, or mercury, often plays a very important role in these religious and ethno-medical rituals.

In the practice of Santeria, azogue is believed to give "resguardo" or protection or even provide "cantazo" or a "strike against the person." Espiritismo, also known as the "work of the dead," is part of a traditional healing ritual in which people maintain relationships with the "angel guardian" (guardian angel) and "gufas" (spirit guides). Mercury is integral in the ceremonial practice of these belief systems, and is apparently widely used in this

Elemental mercury is commonly found for sale over-the-counter in stores known as 'botanicas' or 'yerberias'

Magico-Religious Use of Metallic Mercury

- * Used as a floor wash or cast directly onto floors to provide protection against evil spirits
- * Sprinkled into automobile interiors for protection
- * Ingested directly
- * Applied to the skin or used in spiritual cleansing baths
- * Placed in oil lamps or candles illuminated for protection
- * Kept inside vials and worn as charms or amulets
- * Used to provide love spells

Source: Michael I. Greenberg, MD, MPH

See Report of EPA Superfund's 'Ritualistic Uses of Mercury Task Force' at www.epa.gov/mercury/ under 'Reports and Publications.' Also see the web site of the Mercury Poisoning Project www.mercuryproject.org

regard. The metallic mercury used by practitioners of these healing faiths is used in many different ways as listed in the table.

The uses of mercury in these magico-religious rituals are legion and appear to be widespread. In fact, a recent survey revealed that most U.S. cities with large Hispanic populations had functioning botanicas, and that the vast majority of these stores sold mercury over-the-counter. These sales are unregulated by local or state governments, and the product is unaccompanied by any significant cautionary information regarding the health hazards of mercury. In fact, many of the botanicas actually advocate the use of mercury in the most dangerous ways, usually resulting in aerosolization and creation of an inhalation hazard.

Total Mercury Sales

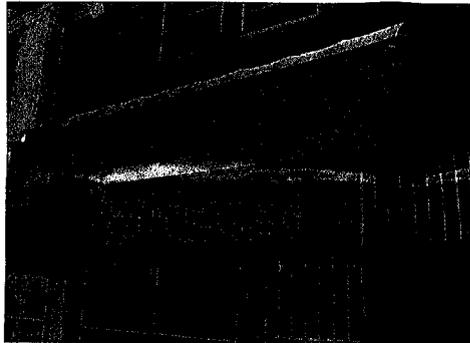
A 1996 report discovered that 35 botanicas in the Bronx, NY, had collectively sold more than 150 nine-gram units of mercury per day. This would represent total mer-

grossly elevated levels of mercury were reportedly found in her breast milk, thus posing a compound hazard to mother and child.

clinically with rather vague and non-specific findings such as fatigue and lethargy. In addition, tremor, visual difficulties, tachycardia, dermatographism, and gingivitis may also be seen.

A typical triad of symptoms of chronic elemental mercury intoxication includes excitability, tremor, and gingivitis. As in many environmental toxic exposures, the key to successful treatment, and, in fact, the first step in that treatment, involves identification of the source of exposure and its prompt removal.

The sorts of mercury exposures discussed in this report compel emergency physicians to be diligent and vigilant. The specific populations identified often



Elemental mercury — "azogue" as it is known in the Hispanic community or "vi dajan" in the Haitian community — is commonly found for sale over-the-counter in stores known as "botanicas" or "yerberias," such as the one shown here.

The magico-religious uses of mercury really tell a story of toxic potential rather than a story of specific and predictable toxicity. The fact is that the total potential that these sources of mercury pose is impossible to calculate or even estimate accurately. There are many important variables, and each locale where these practices occur may have specific threats germane to them.

It is clear, however, that the uncontrolled use of ceremonial mercury is widespread, not currently being evaluated effectively, and is certainly not well appreciated. In fact, a recent search of the Internet revealed numerous

"cyber-botanicas," all of which were advertising the sale of mercury. One Internet site advertised the unrestricted sale of azogue via mail for only \$18 per pound.

Medical Hazards

The medical hazards of aerosolized and inhaled mercury are well recognized and have been well described in the scientific literature. In fact, accidental mercury intoxication by entire families following inadvertent vacuuming of small amounts of spilled mercury is well known. What is not well known is the potential biological impact that large amounts of mercury dispersed within homes, cars, and directly onto individuals will pose.

If individuals live in a particular apartment and engage in such practices, the apartment or dwelling certainly will become contaminated with mercury. Subsequent inhabitants of these dwellings will never know they are facing the potential of continuing, potentially serious exposure to mercury.

Knowledge of the fact that mercury is being widely used by specific populations is critical information for emergency physicians. Specifically, chronic elemental mercury intoxication often presents

If individuals engage in using mercury to ward off evil, their dwelling certainly will become contaminated with mercury

One Internet site advertises the unrestricted sale of mercury via mail for only \$18 per pound

cury sales of more than 420 kilograms for these stores alone. Extrapolating this to the potential for environmental catastrophe and human health hazard, these numbers suggest that it is possible that more than 13,000 Bronx dwellings will have a mean weight of nine grams of mercury dispersed in them per year. Of course, the possibility does exist that fewer dwellings are contaminated but with even higher mercury burdens than reported.

In 1997, a report by the Chicago Department of Health revealed that 15 of 79 Hispanic adults interviewed in Chicago admitted to using mercury regularly for magico-religious purposes. In a non-published study, Dr. Clyde Johnson of the City University of New York discovered that 44 percent of adults of Caribbean descent and 27 percent of Hispanic ethnicity (n=203) indicated that they used mercury in their homes or carried it in their cars or on their person.

Shockingly, more than half of those interviewed indicated that they routinely disposed of mercury in their household garbage. One case of special interest involved a woman of Dominican descent who had been adding mercury to her cologne and applying the cologne to her skin daily. As a result of this practice,

present to inner city emergency departments. Practitioners in these areas are urged to explore the possibility that occult or overt mercury exposure may have occurred. Taking a careful history will require careful questioning, and in many cases will require careful language translation and interpretation.

Sensitivity to the fact that the exposures may be part and parcel of religious ceremonies will be essential. That these ceremonies are of special importance to the patient yet foreign to the physician may challenge the physician's history-taking skills. In any case, emergency physicians in any practice setting should be prepared to recognize the possible mani-

A 1997 report by the Chicago DOH revealed that 15 of 79 Hispanic adults interviewed in Chicago admitted to using mercury regularly

festations of chronic elemental mercury exposure in ethno-religious ceremonies. In addition, emergency physicians may find themselves taking the lead in reporting environmental contaminations and exposures to local and state public health officials, and providing necessary educational information to patients who may be using mercury in this way. ■

Elemental Mercury Use in Religious and Ethnic Practices in Latin American and Caribbean Communities in New York City

Clyde Johnson
Medgar Evers College

Elemental mercury is used in folk medicine and in certain religious practices in the Latin American and Caribbean communities. However, exposure to mercury can cause serious health problems including neurotoxicity. There are, therefore, concerns that mercury users are exposing themselves to dangerous levels of this toxicant. A survey was conducted to determine the use pattern of elemental mercury in the Latin American and Caribbean communities in New York City. Two hundred and three adults participated in the survey. Forty-four percent of the respondents from the Caribbean and 27% from Latin America stated that they have knowledge of such cultural uses.

INTRODUCTION

Mercury has long been known as a human toxicant. Paracelsus reported on mercury poisoning among miners several centuries ago (Goldwater, 1972). It has also been associated in other occupational exposures such as "Mad Hatters" disease. Elemental mercury is a heavy, silvery liquid at room temperature and pressure. It is remarkably volatile for a heavy metal, with a vapor pressure of 0.002 mm Hg at 20°C. Mercury can exist in three oxidation states: Hg^0 (metallic), Hg_2^{2+} (mercurous) and Hg^{2+} (mer-

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curic)² (Cotton et al., 1972; EPA, 1996). Most of the mercury encountered in the atmosphere is monatomic elemental mercury vapor.

Mercury has many uses including in fluorescent lamps, wiring devices and switches (e.g., thermostats) mercuric oxide batteries, instruments that measure temperature and pressure (thermometers, barometers, etc.), as a component of dental amalgams used in repairing dental caries (cavities). Some of these uses contribute to the ambient, and in some cases, the indoor air mercury levels.

Elemental mercury is a toxic substance that causes many serious health problems. These include neurotoxicity, learning disabilities in children, sleeplessness, acrodynia, lung disease and respiratory failure (Fagala et al., 1992; Karpathios et al., 1991; Schwartz et al., 1992; Klassen et al., 1986). Very young children and fetuses are most vulnerable (Dencker et al., 1983). Exposure to elemental mercury can occur through the air, water, food (usually from contaminated fish) and direct contact (absorption through the skin). Human exposure to elemental mercury occurs primarily from breathing contaminated air. Recently, The Agency for Toxic Substances and Disease Registry (ATSDR) and the Environmental Protection Agency (EPA) jointly issued a mercury alert to the general public (ATSDR, 1997).

It is common knowledge in the Latin American and Caribbean communities that elemental mercury is used in ethnic folk medicine and for religious practices. Elemental mercury is sold under the name "azogue," "azoge" or "quicksilver" in stores (sometimes called Botanicas) which specialize in religious items used in Esperitismo (a spiritual belief system native to Puerto Rico), Santeria (a Cuban and Brazilian-based religion that venerates both African deities and Catholic saints) and voodoo. The use of mercury in religious practices is recommended in some Latin American and Caribbean communities by family members, spiritualists, card readers and santeros.

In the present work, a survey was conducted to determine the use pattern of elemental mercury among Latin American and Caribbean communities in New York City. Two hundred and three (203) adults (128 Caribbean, 75 Latin American) age 19–56 years were asked about their knowledge or use of mercury in religious/ethnic practices in their homes. Forty-four percent of the respondents from the Caribbean and 27% from Latin America stated that elemental mercury is used in their homes, cars or carried on their person in these cultural practices.

In 1994, the Agency for Toxic Substances and Disease Registry (ATSDR) collaborated with the Hispanic Health Council of Hartford and the Connecticut Department of Health Services (CTDHS) in a project inves-

tigating the use of metallic mercury during spiritual rituals (ATSDR, 1994). Azogue is the term used by the Hispanic community when referring to metallic mercury. Santeria is the product of the syncretism of the worship of the Yoruban deity called the Oricha and the cult of the saints characteristic of Spanish Catholicism. This study found some evidence of mercury use inside homes (14%) and a limited number of persons have been identified who actually use azogue. The Connecticut study focused on the use of mercury among Santeria believers in the Hispanic community of Hartford. Our survey focused on mercury use in folk medicine and in religious and ethnic practices in Latin American and Caribbean communities in New York City.

METHOD

Fourteen (14) Environmental Science students from Hostos Community College in the Bronx, New York, conducted personal interviews with 203 adults in ten sections of New York City. Respondents had to meet two criteria to participate in this survey: (a) be an adult, and (b) be Latin American or Caribbean or of Latin American or Caribbean ancestry. Latin America includes all countries south of the United States of America: Central and South America. The Caribbean is made up of all the islands in the Caribbean Sea. Guyana, which is in South America, was grouped with the Caribbean nations. The survey was conducted in the following areas in New York City: Manhattan—Clinton, Harlem and Hamilton Heights; Bronx—High Bridge, Morris Heights, Concourse Village, Mott Haven, Longwood and East Crotona Park; Brooklyn—Wingate.

After establishing that respondents met the study criteria, they were asked the following questions: (a) is mercury being used in your home in religious/ethnic practices, (b) how is mercury used in the home, (c) how often is mercury used in the home, (d) would you be willing to have your home tested for mercury, (e) how many children are in the home, (f) what are the ages of the children, (g) would you be willing to have your children tested for mercury, (h) from where did you obtain the mercury, (i) what is your or ancestors' place of origin (Latin America or Caribbean) and (j) how do you dispose of "used" or surplus mercury.

Students were instructed on the sensitive nature of this survey and on the importance of being nonjudgemental and professional. They were instructed to focus on and emphasize the Environmental Science and Public Health concerns of our research. Informed consent was obtained after the research objectives were explained to participants. Because of the sensitive

POPULATION AND ENVIRONMENT

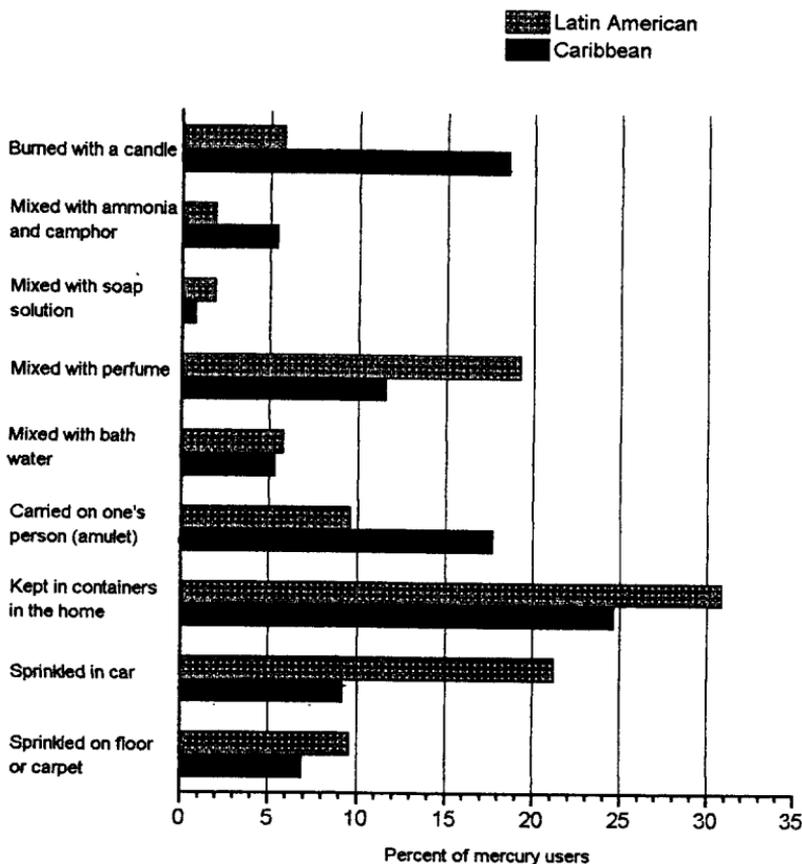


FIGURE 1. Elemental mercury use in religious and ethnic practices in Latin American and Caribbean Communities in New York City.

nature of such a survey, the names of the respondents were not requested and information about their specific country of origin was optional.

RESULTS

Fifty-four percent (54%) of those respondents who are users said that they use mercury in several different religious and ethnic practices. Some sprinkle it in their homes and cars, burn it with candles, add it to their bath water, soap solution and perfume, or wear an amulet containing mercury. Figure 1 lists the different uses. Thus, exposure is from multiple sources.

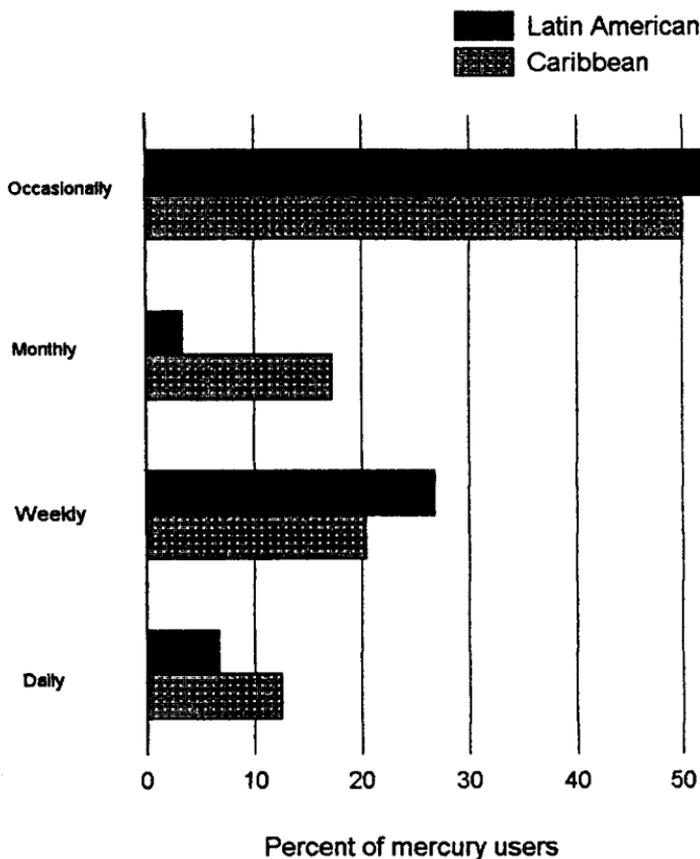


FIGURE 2. Frequency of elemental mercury use in religious and ethnic practices in Latin American and Caribbean Communities in New York City.

Figure 2 gives the frequency of mercury use in the Latin American and Caribbean communities. Fifty-four percent (54%) of the Latin American and 50% of the Caribbean practitioners use it occasionally. Twelve percent of the Caribbean and 6% of the Latino practitioners use mercury daily. The second largest groups of users in both communities are the weekly users. It is important to note here that exposure to mercury may not be limited to religious practitioners and their families, but includes all visitors to contaminated homes and passengers in contaminated cars. During the survey, we asked respondents how they disposed of their mercury and learned that "used" or "surplus" mercury was being disposed of improperly. Sixty-four

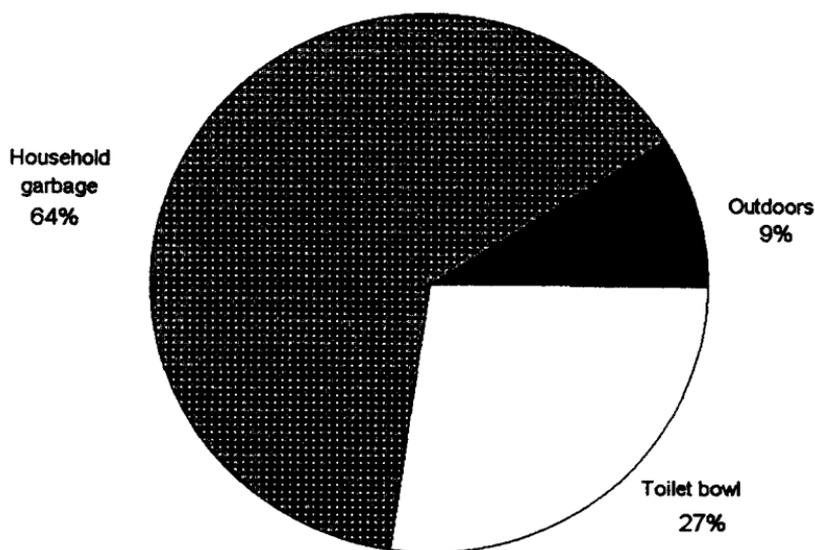


FIGURE 3. Methods of disposal of elemental mercury used in religious and ethnic practices in Latin American and Caribbean Communities in New York City.

percent said they threw it in the garbage, 27% flushed it down the toilet and 9% threw it outdoors (Figure 3).

Table 1 shows that 66% of the respondents who use mercury in religious practices and 64% of the respondents who are nonusers would welcome indoor air measurement for this metal. Sixty-one percent (61%) of mercury users and 63% of nonusers want their children tested for mercury. Thus, most users and nonusers alike are interested in indoor air measurement and biological testing.

Eighty-two percent (82%) of the respondents said they obtained elemental mercury from a Botánica, 3% brought it with them when they migrated to the US, while a total of 6% got it from their job (unspecified), a pharmacy, their landlord or their parents. The other 9% got it from unnamed sources. Twenty-six percent (26%) of the respondents gave specific country of origin data. Figure 4 gives us a sampling of nationalities involved in these practices. However, this is not truly representative since this information was optional and it was found that Puerto Ricans and Dominicans were more likely to give their country of origin.

TABLE 1

**Respondents from the Latin American and Caribbean Communities
in New York City Who Were Asked Whether They Want Their
Homes and Children Tested for Mercury**

	Indoor Air (% of Respondents)	Biological Testing (% of Respondents)	Want Test Done
Mercury users	66	61	Yes
	34	39	No
Mercury nonusers	64	63	Yes
	36	37	No

DISCUSSION

The results suggest that elemental mercury is ever present in the living environment of frequent users who are almost certainly receiving high and continuous doses. The highest exposure levels of mercury vapor are probably associated with burning elemental mercury with a candle. The temperature of a typical candle flame normally exceeds 500°C. The boiling point of liquid mercury is 356.9°C. This means that if the mercury is in contact with the flame for an appreciable amount of time, at least some of it will vaporize and fill the room with harmful vapors. This practice is theoretically the most hazardous. Adding mercury to bath water and soap solution may result in multiple exposures from inhalation, skin absorption and accidental swallowing of bath water. Mercury can also adhere to skin, and will contaminate towels and clothes.

Most human exposure to elemental mercury is by inhalation. Oral and dermal exposure, however, are also important routes of entry (Hursh et al., 1989). Mercury vapor is readily absorbed through the lungs. Studies have shown that 75–85% of inhaled doses of elemental mercury vapor were absorbed by the body (Hursh et al., 1985; Hursh, 1985; Oikawa et al., 1982). Because of its appreciable lipid solubility, the vapor readily diffuses across the alveolar membranes having an affinity for red blood cells and the central nervous system (Berlin, 1986).

The high temperature inside a contaminated car that is parked outdoors on a sunny day will result in very high mercury levels—exposing

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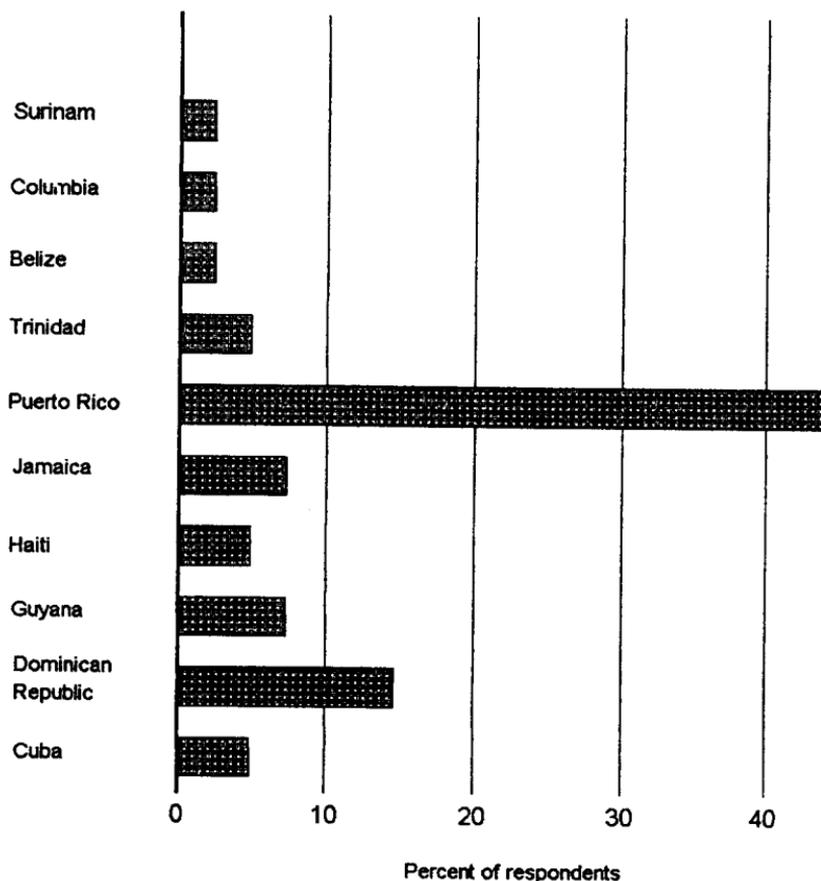


FIGURE 4. Country of origin of 26% of the respondents from the Latin American and Caribbean communities in New York City who use elemental mercury in religious and ethnic practices.

riders to potentially high doses. Some mercury-containing folk medicines are taken orally. Oral exposure is thought to be of little toxicologic consequence since metallic mercury is only slowly absorbed from the gastrointestinal tract (0.01 percent) (Fagala et al., 1992). Frequent mercury users are probably receiving very high and continuous doses.

Elemental mercury and its vapor are extremely difficult to remove from skin, clothes, furniture, carpet, floors and walls. It accumulates in electronic equipment such as computers where it vaporizes and condenses as the instrument is turned on and off in a continuing cycle depending on the temperature. Additionally, since some people use mercury frequently

and the residence life of mercury is estimated to be much longer than one year; when that mercury user vacates the property, the new occupants are unwittingly exposed to mercury for many months.

Improper disposal of mercury down the toilet bowl or in the garbage, contributes to the high mercury load found in sewage and garbage (Figure 3). It is commonly thought that the high mercury levels in sewage and garbage in New York City come from dental clinics. Our survey suggests that improper disposal by religious practitioners in the Latin American and Caribbean communities may contribute to this burden. Outdoor disposal is likely to contribute to the mercury load in the local atmosphere.

The Clean Air Act Amendments (CAA) of 1990 requires the United States Environmental Protection Agency (EPA) to study mercury emissions from electric utility steam generators, municipal and medical waste generators and other sources, including area sources. The U.S. EPA interpreted the phrase ". . . and other sources . . ." to mean that a comprehensive examination of mercury sources should be made and to the extent that data were available, air emissions should be quantified. Religious and ethnic uses of metallic mercury may pose a health problem but data are not available to assign a quantitative estimate of exposure, dose and health effects.

Very little data exists on the dynamics of mercury cycling in indoor air. For ambient air, studies indicate that the residence time of mercury in the atmosphere may be in the order of a year, allowing its distribution over long distances, both regionally and globally, before being deposited to the earth (EPA, 1996). Even after it deposits, mercury commonly is emitted back to the atmosphere either as a gas or in association with particulates to be re-deposited elsewhere. Humans, plants and animals are routinely exposed to mercury and accumulate the metal during this cycle, potentially resulting in a variety of ecological and human health impacts (EPA, 1996). Sprinkling or accidentally spilling elemental mercury on clothes, furniture, carpet, floors, walls, in cars, the natural environment and even the human body will result in contamination. The use of elemental mercury in homes and apartments poses a health risk to anyone who spends time in these locations. It has been shown that accidental exposures to elemental mercury vapors in private homes have led to interstitial pneumonia, dyspnea, lung disease and respiratory failure (Hallee, 1969; Snodgrass et al., 1981; Taueg et al., 1992). The results of this survey suggest that moderate to extensive contamination of dwellings and cars can occur following religious/ethnic use of mercury.

There is evidence that the EPA's Mercury Study Report overlooked or underestimated the contributions of elemental mercury from religious use

to indoor air contamination. The EPA has finalized mercury emission limits for municipal waste combustors, and has proposed mercury emission limits for medical waste incinerators. These emission limits are expected to reduce mercury emissions from these sources by 90% (3). No action is recommended for sources from religious and ethnic uses at this time, but there is a potential public health problem here. The EPA took this position, in part, because of a lack of data. The present study suggests that a comprehensive study of the religious and ethnic uses of elemental mercury should be undertaken including indoor air measurements. Such a study should be given high priority and should be done with the full support and cooperation of the Latin American and Caribbean communities.

ACKNOWLEDGMENTS

The author would like to thank the students of Hostos Community College in the Bronx, New York for collecting the data reported in this paper; and Drs. Michael Iba and Arthur Greenberg for critical reviews of the manuscript.

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Acrodynia and Hypertension in a Young Girl Secondary to Elemental Mercury Toxicity Acquired in the Home

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Abstract: Acrodynia, also known as pink disease, erythredema polyneuropathy, Feer syndrome, and raw-beef hands and feet, is thought to be a toxic reaction to elemental mercury and less commonly to organic and inorganic forms. Occurring commonly in the early 20th century, acrodynia is now a seemingly extinct disease in the modern world because of regulations to eliminate mercury from personal care products, household items, medications, and vaccinations. We present a case of a 3-year-old girl with acrodynia secondary to toxic exposure to elemental mercury in the home environment.

CASE PRESENTATION

A 3-year-old girl was admitted with a 3-day history of redness, pain and swelling of both hands, profuse sweats, irritability, chills, poor oral intake, and severe periumbilical pain. Within the 2 weeks before admission, she had been evaluated in the emergency department on two separate occasions for abdominal pain, which was diagnosed as constipation and viral gastroenteritis. Examination at admission revealed redness and edema of the hands and feet, desquamation of the fingertips and toes, and mild webspace maceration (Figs. 1 and 2). Lymphadenopathy, conjunctival injection, and mucous membrane involvement were absent. Blood pressure was 158/100. Differential diagnoses of her hypertension and systemic symptoms included pheochromocytoma, neuroblastoma, coarctation of the aorta, and vasculitis. Cutaneous differential diagnoses initially included atypical Kawasaki syndrome, postviral acral desquamation,

erythromelalgia, and juvenile plantar dermatosis in the setting of preexisting atopy. Total metanephrine level was high at 475 pg/mL (normal ≤ 205 pg/mL), but was nondiagnostic of a catecholamine-secreting tumor, which typically is greater than four times the reference range. Magnetic resonance imaging, angiography, and echocardiogram excluded internal masses, aortic coarctation, and other cardiovascular abnormalities. Thereafter, mercury toxicity was suspected, and later confirmed by a 24-hour urine mercury level of 178 $\mu\text{g}/24$ hours (normal 0–20 $\mu\text{g}/24$ hours). Hypertension was managed with amlodipine and labetalol. Chelation therapy with succimer was initiated. A compounded topical preparation containing mexiletine 2%, a lidocaine analog, and ketamine 2% applied to her hands and feet provided transient pain control. There was no history of excess fish intake or exposure to mercury, broken thermometers, batteries, or fluorescent bulbs. Environmental survey of the home, where the

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Figure 1. Desquamation of the fingers.



Figure 2. Desquamation of the toes.

family had lived for 2 months, revealed mercury levels in the carpet of $40,000 \mu\text{g}/\text{m}^3$ (normal $< 100 \mu\text{g}/\text{m}^3$). After 5 weeks of chelation therapy, all signs and symptoms had resolved.

DISCUSSION

Acrodynea, also known as pink disease, erythroedema polyneuropathy, Feer syndrome, and raw-beef hands and feet, is a syndrome related to elemental mercury and, less commonly, inorganic mercury salt intoxication primarily in children (1,2). Chardon first described it in the French literature in 1830, and Crawford later recognized it in the American literature in 1932 (3,4), but it was not until 1948 that Warkany and Hubbard (5) established a

connection between acrodynea and mercury toxicity. It presents with the triad of edematous, painful, pink to red, desquamating fingers and toes; neurologic symptoms (irritability, photophobia, weakness, paresthesias); and hypertension (6). Elemental mercury exists as a liquid that can evaporate at room temperature. It is thought that elemental mercury toxicity affects children more often than adults because their nostrils are nearer the floor and because mercury vapor, which is heavier than air, settles near the floor because of the effect of gravity (6,7). In addition, children have higher minute volume respiration per unit of weight and therefore inhale more air per unit of body weight than do adults (7).

The diagnosis of acrodynea may be easily overlooked because of its current rarity in North America and Europe. As noted in the literature, there is substantial clinical overlap between acrodynea and Kawasaki disease (7). One author previously suggested mercury as the causative agent of Kawasaki disease (8). This led to a study evaluating mercury levels in six patients with a clinical diagnosis of Kawasaki disease; all were found to have high urinary mercury excretion, although later reports failed to confirm this association (9). Acrodynea should also be considered in the differential diagnosis for patients with presumed Kawasaki disease who are afebrile or have atypical presentations.

Another cardinal feature of acrodynea is hypertension. Mercury causes high blood pressure by inhibiting catecholamine-*O*-methyltransferase, the critical enzyme involved in catabolism of catecholamines, through direct inactivation of its coenzyme *S*-adenosylmethionine. Inhibition of catecholamine-*O*-methyltransferase by mercury results in accumulation of dopamine, epinephrine, and norepinephrine (10), which probably explains the high catecholamine levels seen in our patient. In addition to following mercury levels in response to treatment, catecholamine levels may also be tracked as a surrogate marker of therapeutic response (2).

Although it was determined that the patient in our case was exposed to elemental mercury in the carpeting of her new home, its source could only be speculated. Common residential sources include spillage from mercury-containing devices such as thermometers and contact with latex paint containing mercury added to prolong shelf life. In addition, some religions in Afro-Caribbean cultures, including Santeria, voodoo, and Palo, ritually sprinkle elemental mercury about the home to ensure health, wealth, and happiness (11,12). The concern with elemental mercury in flooring and upholstery is that it can persist for weeks to months, resulting in chronic exposure to mercury vapor (13). This may increase the risk of toxicity, because it has been shown that urine mercury levels correlate positively with duration of

residency in a contaminated building and total amount of time spent in the building (14). Vacuuming worsens mercury exposure by further dispersing the vapor, and clearance should not be attempted without guidance from the local health department (13).

One must have a high index of suspicion to recognize mercury toxicity. If suspected, laboratory testing of blood, urine, or hair samples can be performed for confirmation. Whole blood should be examined as opposed to serum, because mercury concentrates in erythrocytes, urine should be collected over a 24-hour period rather than spot checking, and the longest of hair strands should be evaluated (7). Because mercury has a short half-life in the blood but a long half-life in other tissues, blood samples are more useful for diagnosing acute poisoning, whereas urine and hair samples are better for diagnosis of chronic intoxication (7). Although reference levels are not well established for children, the threshold for toxicity is probably lower than in adults, and clinical correlation is recommended.

Treatment entails removal of the source of mercury exposure in the patient's environment with the aid of trained personnel and elimination from the body largely through chelation therapy. The Food and Drug Administration has not approved any therapy for mercury toxicity in children, but DMSA succimer is approved for the treatment of lead poisoning in children and has been adopted as the most commonly used chelating agent for mercury in the pediatric population (15). Other agents less commonly used are D-penicillamine, 2,3-dimercaptopropanol (British anti-lewisite, dimer-caprol), and 2,3-dimercapto-1-propane sulfonic acid. Transient elevation in plasma mercury levels may occur with use of these agents because of oxidation within red blood cells (7). Repeat blood or urine mercury levels should be performed after chelation therapy to ensure that the level has decreased appropriately.

Although acrodynia is now relatively rare, cases such as ours may still be encountered. Awareness and recognition of the characteristic cutaneous findings of red, desquamating, and edematous hands and feet coupled

with high blood pressure and neurologic symptoms will prevent the diagnosis from being overlooked. Prompt diagnosis and treatment of this disorder may help prevent long-term neurological sequelae.

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Elemental Mercury Poisoning in a Household — Ohio, 1989

On November 22, 1989, a 15-year-old male who had been hospitalized in Columbus, Ohio, was diagnosed with acrodynia, a form of mercury poisoning. This report describes the investigation by the Columbus Health Department (CHD) to determine the source of the patient's exposure to mercury.

In early November, following an acute illness, the patient was diagnosed with acrodynia. He was subsequently referred for psychiatric evaluation because of his declining performance in school and nonspecific complaints (e.g., aches, irritability, inability to think clearly) that were presumed to be psychosomatic. On November 17, he was admitted to the hospital after his blood pressure measured 142 mm Hg systolic and 106 mm Hg diastolic. Additional manifestations noted at that time included rash, sweating, cold intolerance, tremor, irritability, insomnia, and anorexia. An analysis of a 24-hour urine collection detected a mercury level of 840 $\mu\text{g/L}$ (reference: $<20 \mu\text{g/L}$ [1]), acrodynia was diagnosed. On December 1, the patient's 15-year-old sister was hospitalized with hypertension, mild acrodynia, irritability, and generalized muscle weakness. Her 24-hour urine mercury level was 1500 $\mu\text{g/L}$. Although both parents were asymptomatic, their 24-hour urine mercury levels were 1250 $\mu\text{g/L}$ and 1250 $\mu\text{g/L}$.

On November 29, the CHD investigated the apartment where the family had lived from August 26, 1989. Neighbors reported that the previous tenant had spilled a large amount of elemental mercury within the apartment. Although this tenant could not be held responsible for confirmation, mercury vapor concentrations in seven rooms ranged from 100 $\mu\text{g/m}^3$ (the Agency for Toxic Substances and Disease Registry's acceptable maximum concentration for indoor air mercury concentration is $\leq 0.5 \mu\text{g/m}^3$ [2]). The apartment was sealed, pending decontamination efforts which are ongoing. In three other apartments in the same building, air mercury concentrations were less than the measuring instrument's detection limit of 10 $\mu\text{g/m}^3$. The CHD did not detect evidence of mercury vapor contamination in a mobile home where the patients' family had relocated in November 1989.

After both patients were diagnosed as having acrodynia with neuropsychiatric impairment, they were treated with oral 2,3-dimercaptosuccinic acid (DMSA). From November 1, 1989, to April 4, 1990, the male patient's 24-hour urine mercury values ranged from 1540 $\mu\text{g/L}$ to 101 $\mu\text{g/L}$. Except for a persistent mild tremor, acrodynia and other neurologic symptoms resolved following two 21-day courses of DMSA therapy. The female patient's course was complicated by a progressive sensorimotor peripheral neuropathy that caused profound upper and lower extremity weakness. Following DMSA treatment, she gradually improved; within 3 months, she was able to walk short distances without assistance. By February 6, 1990, her 24-hour urine mercury excretion was 352 $\mu\text{g/L}$; DMSA therapy was continued.

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Mercury Poisoning — Continued

Editorial Note: Although nonoccupational elemental mercury poisoning occurs less frequently than occupational mercury poisoning (3), cases of elemental mercury exposure and toxicity in children have been reported (3-9). Because mercury vapors are dense and tend to settle, children playing near the floor may be exposed to mercury if it is present (8). Moreover, children may be physiologically more susceptible to the health hazards of mercury exposure than adults.

Elemental mercury (also termed metallic mercury or quicksilver) is volatile at room temperature, and its rate of vaporization is a function of both temperature and surface area (10). Mercury enters the bloodstream after it is inhaled; because of its lipid solubility, mercury crosses both the blood brain barrier and the placenta (1,11,12). Elemental mercury is excreted in the urine and has an elimination half-life of approximately 60 days (11).

Because of mild symptomatology and the potential for misdiagnosis, cases of mercury poisoning may not be readily recognized. Individual susceptibility to mercury poisoning varies considerably, and not all persons exposed will develop symptoms (5). Manifestations of mercury poisoning include intention tremor, memory loss, insomnia, timidity, gingivitis, diarrhea, anorexia, weight loss, and, in severe cases, delirium. Acrodynia may be misdiagnosed as measles, other viral exanthems, or Kawasaki disease. Manifestations of acrodynia include a generalized rash; irritability; photophobia; profuse perspiration; and redness, swelling, and peeling of the skin on hands and feet (11,12). Although acrodynia is more common in infants and young children, it has been reported in adolescents and a 41-year-old male (5).

Mercury is used in some school laboratories; in such settings, its ambient concentrations (and the safeguarding of mercury supplies) should be carefully monitored. Additionally, mercury is added into many household products, such as latex paints, adhesives, joint compounds, acoustical plates, and cleaning solutions. Because not all products that contain mercury are labeled as such, adequate ventilation must be ensured when using potentially toxic household chemicals.

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Sudan — Continued

Efforts to address health problems during negotiated periods of tranquility in civil and military strife have been conducted previously in Lebanon, El Salvador, Sudan, and other countries; however, the duration of these efforts has been substantially shorter than the current program in Sudan. On May 25, the government of Sudan and opposing forces announced their willingness to extend the cease-fire for an additional 6 months through late July to enable continued disease-control efforts.

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Mercury Exposure in a Residential Community — Florida, 1994

Residential exposure to elemental mercury typically involves small amounts (e.g., the approximately 0.3 mL in a thermometer). During August 1994, five children residing in a neighborhood in Palm Beach County, Florida, found 5 pints of elemental mercury in an abandoned van. During the ensuing 25 days, the children shared and played with the mercury outdoors, inside homes, and at local schools. On August 25, 1994, a parent notified local police and fire authorities that her children had brought mercury into the home. On the same day, 50 homes were immediately vacated and an assessment of environmental and health impacts was initiated by the State of Florida Department of Environmental Protection, the Health and Rehabilitative Services of the Palm Beach County Public Health Unit, and the U.S. Environmental Protection Agency. This report summarizes the investigation of this incident.

Door-to-door interviews of the entire neighborhood (n=363) were conducted, and a decontamination facility was established at the civic center. Based on information collected during the initial survey, residential structures and several classrooms at the local high school were tested for the presence of mercury. Ambient air samples (i.e., adult breathing zone grab samples collected approximately 5 feet above the floor) were collected in affected structures during the 6 days following the report of children handling mercury. In addition, during August 25–29, initial blood and urine samples were collected from potentially exposed persons and analyzed for mercury levels.

A total of 58 residential structures were monitored for indoor mercury vapor concentrations; unsafe indoor air levels of mercury (>15 µg/m³) were detected in 17, prompting the immediate evacuation of 86 persons. Several classrooms at the local high school were determined to be contaminated. This school was closed for 4 days until clearance air sampling indicated that the mercury level was ≤10 µg/m³. This level of mercury was considered safe for students and teachers rotating among the rooms for 50-minute classes. Pregnant women and young children were excluded from entering classrooms until mercury levels decreased to ≤0.3 µg/m³.

A total of 477 persons identified by the survey as potentially exposed were evaluated at the emergency department of the local hospital or the health department clinic for mercury poisoning by testing both blood and urine specimens for total inorganic mercury levels. Elevated blood and/or urine mercury levels were detected in

Mercury Exposure — Continued

54 persons: blood levels ranged from 1.1 µg/dL to 5.5 µg/dL (normal: <1 µg/dL) and urine levels ranged from 21 µg/L to 66 µg/L (normal: <20 µg/L). Ambient air samples ranged from 6.5 µg/m³ to 300 µg/m³. Although these 54 persons were asymptomatic, concentrations of mercury detected in their blood and urine were consistent with the levels of mercury detected in their homes.

Homes and classrooms were decontaminated by spreading powdered sulfur absorbent on the floors and vacuuming surfaces with high efficiency particulate-arresting (HEPA) filters. Contaminated items (e.g., carpeting, padding, linoleum, clothing, bedding, vacuum cleaners, furniture, and washing machines) were removed and taken to a hazardous waste facility, and some homes required ventilation for periods up to 3 months. Because of the potential for residential exposure of many children and childbearing-aged women, an air mercury concentration of ≤0.3 µg/m³ was established as a threshold at which families would be permitted to return to their homes. Ambient air samples were collected 24 inches above the ground (i.e., a child's breathing zone), under normal living conditions for at least 8 hours.

By December 1, 1994, all displaced families had been permitted to return to their homes, and urine mercury levels of all exposed persons decreased. However, the Palm Beach County Health Department continues to monitor persons with persistently elevated urine mercury levels. This incident is under criminal investigation, and information regarding the source of the mercury has not been released.

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Editorial Note: Most poisonings associated with exposure to elemental mercury occur in occupational settings, and reports of nonoccupational elemental mercury vapor poisonings are rare, especially in community-based settings (1,2). The exposures described in this report primarily affected homes and schools.

Inorganic mercury is a heavy, silver-white metal that is liquid at room temperature. The vapor pressure of mercury is high compared with other metals, creating the continual hazard of airborne exposure to mercury vapor, which is odorless and colorless. Mercury is absorbed into the blood following inhalation and is then transported to the brain and other areas of the nervous system and to all other tissues. Most elemental mercury is excreted unchanged in feces.

The development of clinical manifestations as the result of inhalation of mercury vapor is related to several factors, including the concentration of vaporized mercury, length of exposure, and individual susceptibility (2,3). Acute exposure to elemental mercury produces symptoms of metallic taste, burning, irritation, salivation, vomiting, diarrhea, upper gastrointestinal tract edema, abdominal pain, and hemorrhage (4). Symptoms of high levels of exposure usually begin abruptly and include fever, chills, malaise, nausea, coughing, shortness of breath, chest pain and tightness; the clinical course may progress to pulmonary edema and death (5). In comparison, chronic inorganic mercury poisoning can result in intention tremor, memory loss, insomnia, depression, irritability, excessive shyness, emotional instability, delirium, and acrodynia and may result in a neurologic syndrome known as "mad hatter syndrome" (2–5).

Mercury Exposure — Continued

The risks associated with mercury exposure are especially increased for children because mercury vapor is dense and settles (2) and because children may be active on the floor or playing in dirt. In addition, because of lipid solubility, mercury crosses the placenta and is excreted in breast milk and, therefore, is a potential health hazard for unborn children and breastfeeding infants (6,7).

Elemental mercury is still widely used in industry for the manufacture of thermometers, barometers, vacuum pumps, and electrical components and may be present in household products such as cleaning solutions and adhesives (2,5). Small amounts of mercury, such as from a broken thermometer, can be cleaned up by spraying the mercury gently with hairspray or dusting with an absorbent such as powdered sulfur and sweeping up the mercury and absorbent with a wisk broom. After cleaning the spill, the broom should be securely bagged and discarded (8). Any person who discovers a large quantity of mercury should immediately contact the local poison-control center or health department.

The residential exposure described in this report was unprecedented in terms of the amount of mercury involved and the extent of contamination. The rapid and coordinated response to this incident minimized the risk for and assured the health of the exposed residents.

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**Unexplained Illness Among Persian Gulf War Veterans
in an Air National Guard Unit: Preliminary Report —
August 1990–March 1995**

In November 1994, the U.S. Department of Veterans' Affairs (VA), the Department of Defense (DoD), and the Pennsylvania Department of Health requested that CDC investigate a report of unexplained illnesses among members of an Air National Guard (ANG) unit in south-central Pennsylvania (Unit A) who were veterans of the Persian Gulf War (PGW) (August 1990–June 1991). These veterans had been evaluated at a local VA medical center for symptoms that included recurrent rash, diarrhea, and fatigue. A three-stage investigation was planned to 1) verify and characterize signs and symptoms in PGW veterans attending the VA medical center; 2) determine

CLIA — Continued

Although incomplete compliance with CLIA regulations for hemoglobin screening may be related to lack of provider knowledge about CLIA regulations, determinants for noncompliance must be further assessed (CHDP providers, personal communications, March 12–April 6, 1995). In California, possible methods to improve provider compliance with CLIA regulations for hemoglobin screening include 1) distributing thorough professional organizations information highlighting CLIA regulations and the value of appropriate quality assurance in hemoglobin testing, 2) requiring providers to demonstrate adherence to quality laboratory methods for hemoglobin testing as a criterion for participation as a provider in a state or federally funded program, and 3) requiring ongoing in-service education for providers and their laboratory technicians about CLIA regulations for continuation as a provider in a state or federally funded program.

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Mercury Exposure Among Residents Of a Building Formerly Used for Industrial Purposes — New Jersey, 1995

Potential sources of elemental mercury in residential settings include mercury switches, mercury-containing devices (e.g., thermostats and thermometers), and mercury obtained from laboratories, dental offices, or other industrial sources. In January 1995, pools of elemental mercury were found in a five-story factory building that had been converted to residential use in Hoboken, New Jersey; the building previously had been used to manufacture mercury vapor lamps. This report summarizes the investigation by the New Jersey Department of Health (NJDOH), the U.S. Environmental Protection Agency (EPA), the Agency for Toxic Substances and Disease Registry (ATSDR), the Hoboken Board of Health, and the Hudson Regional Health Commission (HRHC), which identified high levels of mercury vapor in the building and indicated that residents had been exposed to high levels of mercury.*

The five-story brick building included 17 condominium units and one attached townhouse with a total of 32 residents; six were children aged 9 months–8 years. Workers renovating an unoccupied condominium unit on the fifth floor initially found pools of mercury in the subflooring. The tenants' association hired a private contractor to remediate the contamination. During remediation, mercury-contaminated debris (e.g., wood flooring) was removed from the unit. In March 1995, a private consultant for the tenants' association found detectable levels of mercury vapor in units on all five floors. The highest levels of mercury were 5 µg/m³ in breathing zone areas and 888 µg/m³ in areas where liquid mercury was visible; both of those levels were recorded on the fifth floor. In comparison, for other residential properties known to have been contaminated with mercury, ATSDR has recommended indoor air mercury levels be <0.3 µg/m³ (0.0003 mg/m³) to protect public health (1,2).

*Copies of the health consultation report are available from ATSDR, telephone (404) 639-6066.

Mercury Exposure — Continued

In October 1995, drops of elemental mercury were observed in fourth-floor units, including on stove and countertop surfaces. Mercury vapor measured by a private consultant found levels on the fourth floor of 7 µg/m³ to 26 µg/m³. In late November, urine mercury levels for five residents of the two fourth-floor units ranged from 11 µg/L to 65 µg/L of urine (normal range: 0–20 µg/L). On December 15, NJDOH was notified of these findings, and on December 22, ATSDR and EPA were asked for assistance. Maximum air mercury levels detected by NJDOH were 10 µg/m³–50 µg/m³. With assistance from ATSDR, the Hoboken Board of Health, and HRHC, NJDOH analyzed urine specimens from 29 of the building's 32 residents; these samples indicated concentrations of mercury in the urine ranging from 5.7 µg/L to 102 µg/L. Of the 29 persons, 20 (69%) (including five of the six children), had urine mercury levels ≥20 µg/L; eight of these residents had urine mercury concentrations >56 µg/L.

On December 29, the Hoboken Board of Health, HRHC, NJDOH, and ATSDR provided the residents with results and interpretation of the urine tests and urged residents to relocate as soon as possible. Because the investigation indicated that residents in all parts of the building had been exposed to mercury vapors and because of the risks associated with vapors in the building and contaminated possessions, on January 3, ATSDR issued a health consultation report that the building was an imminent health hazard; on January 4, the city of Hoboken condemned the building. Inclement weather delayed moving and temporary relocation by EPA of the 32 residents and screening of their belongings for contamination until January 12, 1996. Residents were referred for medical evaluation at an environmental and occupational health specialty center. EPA is continuing the investigation to determine whether the building can be remediated.

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Editorial Note: Elemental mercury is a shiny, silver-white odorless liquid. Some evaporation of elemental mercury occurs at room temperature to form mercury vapor, a colorless, odorless gas; the evaporation is enhanced by heat. Mercury vapor, the source of the exposures described in this report, is more dense than air and, therefore, settles on or near the floor. Because of this effect, children especially are at risk for adverse effects of exposure to mercury (3).

Mercury affects the central and peripheral nervous systems and the kidneys. Fine tremors in the fingers, eyelids, and lips are early signs of mercury toxicity. With increasing exposure, tremors in the hands and arms may interfere with precise movements and impair skills such as handwriting. Common behavioral symptoms of mercury toxicity include depression, irritability, exaggerated response to stimuli, excessive shyness, insomnia, and emotional instability (4). In occupational exposure studies, workers with urine mercury concentrations >56 µg/L exhibited neurotoxic effects such as decreased performance on verbal concept formation and memory tests (5). Neurobehavioral tests and other standardized test batteries have been used to assess persons exposed to mercury and other neurotoxic agents in environmental and occupational settings (6–10).

Mercury Exposure — Continued

Because of the health effects associated with exposures to mercury and other hazardous substances, these risks must be considered when industrial sites are converted for residential use. The investigation in this report underscores that industrial contamination may not be discovered until after buildings have been converted to residential use. When mercury is discovered in any residential setting, it should be reported immediately to the local health department or poison-control center. Persons at risk for exposure in such settings include residents, former factory workers, and workers involved in the renovation of such buildings.

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Weekly

March 11, 2005 / 54(09);227-229

Lead Poisoning Associated with Use of Litargirio --- Rhode Island, 2003

Lead can damage the neurologic, hematologic, and renal systems (1). Deteriorated leaded paint in older housing remains the most common source of lead exposure for children in the United States; however, other lead sources increasingly are recognized, particularly among certain racial/ethnic populations (2). In 2003, the Rhode Island Department of Health (RIDOH) recognized litargirio (also known as litharge or lead monoxide), a yellow or peach-colored powder used as an antiperspirant/deodorant and a folk remedy in the Hispanic community, as a potential source of lead exposure for Hispanic children. This report summarizes a case investigation of elevated blood lead levels (BLLs ≥ 10 $\mu\text{g}/\text{dL}$) associated with litargirio use among two siblings in Rhode Island, the public health action taken, and a survey of parents/guardians in three pediatric clinics in Providence, Rhode Island, to assess litargirio use. Findings underscore the importance of follow-up of elevated BLLs and thorough investigation to identify all lead sources.

Case Report

In May 2003, RIDOH and the Health & Education Leadership for Providence (HELP) Lead Safe Center investigated unexplained increases in BLLs in twin Hispanic boys aged 7 years (twins A and B). Annual BLL screenings for the twins since age 9 months were not elevated until June 2001, when twins A and B had elevated BLLs of 14 $\mu\text{g}/\text{dL}$ and 15 $\mu\text{g}/\text{dL}$, respectively. Twin A's BLL increased to 42 $\mu\text{g}/\text{dL}$ in May 2003, despite completed remediation of interior lead paint hazards in their home in June 2002 and of exterior lead hazards in May 2003, and provision of parental education about lead poisoning. Similarly, twin B's BLL increased to 26 $\mu\text{g}/\text{dL}$ during the same period. In contrast, their younger brother's initial elevated BLL of 17 $\mu\text{g}/\text{dL}$ in August 2001, at age 9 months, decreased to 8 $\mu\text{g}/\text{dL}$ by November 2002.

In May 2003, RIDOH and HELP Lead Safe Center staff conducted a home inspection, which detected litargirio in a small glass jar in the bedroom of the twins, who used the substance as an antiperspirant/deodorant. The youngest brother did not use litargirio and had a separate bedroom. After the litargirio tested positive for lead by a sodium rhodizonate field test, all litargirio was removed from the home, and a sample was sent to the state laboratory for confirmatory lead testing. The litargirio sample contained 790,000 parts per million (ppm) (79%) lead. Follow-up BLLs decreased for twin A (27 $\mu\text{g}/\text{dL}$ in June, 22 $\mu\text{g}/\text{dL}$ in August, and 13 $\mu\text{g}/\text{dL}$ in November) and twin B (22 $\mu\text{g}/\text{dL}$ in June, 17 $\mu\text{g}/\text{dL}$ in August, and 9 $\mu\text{g}/\text{dL}$ in November).

The twins' visiting grandmother from the Dominican Republic had introduced litargirio into their home and also had given it to the family of their two female cousins, aged 1 and 5 years. In June

2002, the older girl had a BLL of 24 $\mu\text{g}/\text{dL}$, and the younger girl had a BLL of 32 $\mu\text{g}/\text{dL}$. Previous annual BLL screenings for the older girl were not elevated. In July 2002, after a home inspection revealed lead paint hazards, their parents implemented lead hazard control measures. However, the girls BLLs increased to 29 $\mu\text{g}/\text{dL}$ and 44 $\mu\text{g}/\text{dL}$, respectively, by January 2003. The older sister used litargirio sporadically until the family ran out of the product in January 2003, after which her BLLs decreased to 20 $\mu\text{g}/\text{dL}$ in March, 15 $\mu\text{g}/\text{dL}$ in April, and 7 $\mu\text{g}/\text{dL}$ in November. Although the younger girl had not used litargirio, she shared a bedroom with her older sister and likely ingested litargirio residue on various surfaces through hand-to-mouth activity. Her BLLs also decreased to 33 $\mu\text{g}/\text{dL}$ in March, 29 $\mu\text{g}/\text{dL}$ in April, and 16 $\mu\text{g}/\text{dL}$ in November after her sister discontinued using litargirio.

Public Health Action

Litargirio is available locally in botanicas (i.e., shops selling herbs) and bodegas (i.e., grocery stores) located in Hispanic communities. It is manufactured and/or packaged by laboratories in the Dominican Republic and sold in small, clear, plastic packets labeled "litargirio" (Figure). A litargirio sample purchased by RIDOH staff from a local botanica contained 360,000 ppm (36%) lead.

RIDOH issued a statewide health alert on June 30, 2003, warning the public to stop using litargirio and advising pregnant and nursing women and children who used this product to obtain a BLL test. The media provided coverage in both English and Spanish. RIDOH notified CDC and the Food and Drug Administration (FDA) about the litargirio cases and, on October 2, FDA issued a warning to consumers about litargirio. RIDOH notified the Dominican Republic Secretary of Public Health about the high levels of lead in litargirio imported from the Dominican Republic.

Survey

To assess litargirio use in the Hispanic community in Providence, RIDOH and CDC conducted a convenience survey of parents/guardians in three hospital-based pediatric clinics over a 2-week period (weekdays) during January--February 2004. Hospital A (a pediatric clinic and pediatric dental clinic) was surveyed during January 5--9 and 12--16. Hospital B (a pediatric clinic) was surveyed during February 9--13 and 17--20. All parents/guardians were approached to determine whether they were eligible for the survey (i.e., considered themselves Hispanic, were a parent/guardian, lived with a child, and were aged ≥ 18 years). A screening questionnaire was administered to 1,025 persons; 599 (58%) were deemed eligible. Of those eligible, 584 (98%) participated in the survey. Among participants, 157 (27%) had heard about litargirio; of those, 134 (85%) were Dominicans. Among the 134 Dominican participants who had heard about litargirio, the majority (104 [78%]) heard about it as a tradition from their country of origin. Of the 40 participants with a personal or family history of litargirio use, 38 (95%) were Dominicans who typically used the substance while growing up in the Dominican Republic.

No Dominican participants reported current or recent personal use of litargirio. Furthermore, no study participant reported using litargirio before or after the health alert. No additional cases of litargirio-associated lead poisoning have been reported to RIDOH or CDC.

Reported by: *D Silva, Health & Education Leadership for Providence (HELP) Lead Safe Center; J Tourangeau, St Joseph's Hospital Lead Clinic & HELP Lead Safe Center, Providence; R Aglione, M Angeloni, MBA, C Brackett, W Dundulis, MS, Rhode Island Dept of Health. Div of Emergency and Environmental Health Svcs, National Center for Environmental Health; N Reyes, MD, EIS Officer, CDC.*

Editorial Note:

Litargirio is used in the manufacture of batteries, glass, and ceramics; in the vulcanizing of rubber; and as a paint pigment (3--5). Dominicans, particularly those from rural areas, use it as an antiperspirant/deodorant and as a traditional remedy for burns and fungal infections of the feet. This report, the first to describe lead poisoning associated with use of litargirio, demonstrates how a thorough investigation of elevated BLLs led to the discovery of litargirio, a previously unreported source of lead exposure.

Although deteriorated leaded paint in older housing remains the main source of childhood lead exposures, other sources should be considered, particularly when a child's elevated BLL does not respond to remediation of residential lead paint hazards. As described in this report, the BLLs of the twins' youngest brother decreased after residential lead paint hazards were remediated, but the twins' BLLs continued to increase, suggesting exposure to a different lead source. BLL elevations during or immediately after remediation or abatement are uncommon in Rhode Island because of strict control of the process.

Certain racial/ethnic populations at risk for lead exposure through use of traditional or folk remedies (6--9) might fail to disclose use of these products when asked about use of "traditional or folk remedies," rather than by product name. In this report, the twins' mother repeatedly denied use of "traditional or folk remedies" because she considered litargirio an ordinary product (i.e., deodorant), not a remedy. RIDOH now inquires specifically about use of litargirio when visiting Hispanic families of children with elevated BLLs.

Data regarding dermal absorption of inorganic lead compounds in humans is limited but reportedly substantially lower than absorption through inhalation or ingestion (1). Although litargirio was applied to the skin of these children, most of the product probably was ingested through hand-to-mouth behavior after contact with the product or with contaminated surfaces. Twin A, who had the higher BLL, sucked his thumb, supporting this premise.

The findings from the convenience survey are subject to at least two limitations. First, the survey sampled only persons seeking pediatric care at the three pediatric clinics; therefore, the results might not be generalizable to all Hispanic communities in Rhode Island. Second, health warnings about the use of litargirio might have biased participant responses and underestimated the prevalence of litargirio use. However, to minimize participant bias, Hispanic interviewers conducted the survey and collected no identifiers.

The survey results suggest that the prevalence of litargirio use in Rhode Island was minimal. Later attempts by RIDOH staff to purchase litargirio from botanicas or bodegas failed to locate any litargirio. Because of these findings, RIDOH took no further action. Conversely, in New York City (NYC), the NYC Department of Health and Mental Hygiene was able to purchase litargirio from five of eight botanicas visited in NYC after learning about the Rhode Island litargirio cases. One of the five litargirio samples tested contained lead (430,000 ppm [43%] lead). A public warning was issued, and botanica owners were required to remove all litargirio from their stores.

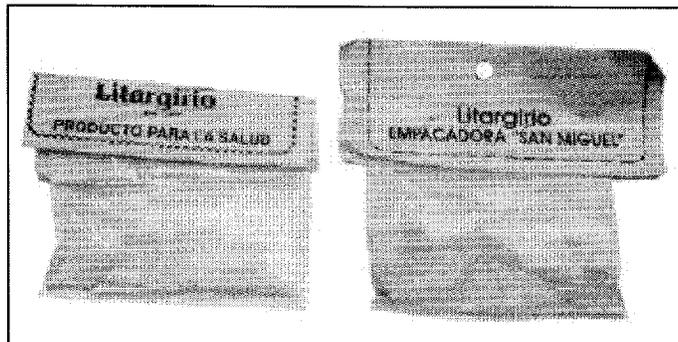
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Figure

FIGURE. Packages of litargirio, a yellow or peach-colored powder, used as an antiperspirant/deodorant and a folk remedy in the Hispanic community



Photo/New York City Department of Health and Mental Hygiene

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EXPROS? MAIL 10 on 9.26

Arnold P. Wendroff, Ph.D.
298 Marlborough Road
Brooklyn, NY 11226
(718) 499-8336
September 26, 1990

Dr. Antonia Novello
Surgeon General
200 Independence Ave. S.W.
Washington DC 20201

Dear Dr. Novello,

I'm writing in order to personally apprise you of a potentially significant health hazard faced by Hispanic communities across the United States, and abroad. The problem is one of widespread ~~domestic mercury vapor exposure~~ **domestic mercury vapor exposure**. I have contacted numerous health agencies listed on the attached sheets, and although they have been aware of the potential problem for some weeks now, we have yet to find our index case. In any event, it was suggested that you might take a personal interest in this problem, and possibly speed up the process of case finding, assessment and policy development which will be needed to address it. I've also enclosed the typescript of my article to Nature describing the problem, my prefatory cover letter to Nature, and a table of data.

If I can be of any further assistance, please feel free to contact me.

Sincerely yours,

Arnold P. Wendroff, Ph.D.



DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

The Surgeon General of the
Public Health Service
Rockville MD 20857

OCT 16 1990

Arnold Wendroff, Ph.D.
298 Marlborough Road
Brooklyn, NY 11226

Dear Dr. Wendroff:

We received your letter in which you expressed concern about the risk of domestic mercury vapor exposure. The ritual of sprinkling mercury on the floor to ward off "evil spirits" is practiced by selected minority groups and may pose potential hazards to those who encounter the mercury.

The Agency for Toxic Substances and Disease Registry (ATSDR) within the Public Health Service is the Agency that specifically is charged with preventing or mitigating the adverse human health effects and diminished quality of life that result from exposure to hazardous substances in the environment and I understand that you have already contacted them. Dr. Cynthia Harris, Ph.D., Chief of the Community Health Branch, Division of Health Assessment and Consultation, ATSDR, is following up on this matter and should be back in touch with you in the near future.

Also, for the past 10 months, Dr. Ruth Etzel, M.D., Ph.D., has been conducting research in the area of mercury exposure. Dr. Etzel is employed at the Centers for Disease Control (CDC), Center for Environmental Health and Injury Control, Division of Environmental Hazards. The CDC is also an Agency within the Public Health Service. We are currently awaiting results from that research. I am confident that these two Agencies will remain vigilant in the pursuit of this potential health threat.

I appreciate your interest and encourage you to continue your efforts to help protect the public's health. Please feel free to contact the above-mentioned resource persons if you have further questions.

Sincerely,



Antonia C. Novello, M.D., M.P.H.
Surgeon General

Subcutaneous Injection of Mercury: "Warding Off Evil"

Venkat L. Prasad

Tri County Community Health Center, Dunn, North Carolina, USA

Deliberate injection of mercury, especially subcutaneous injection, is rare but is seen in psychiatric patients, individuals who attempt suicide, those who are accidentally injected, and boxers who wish to build muscle bulk. Metallic mercury plays a major role in ethnic folk medicine. Neurologic and renal complications can result from high systemic levels of mercury, and subcutaneous injection usually results in sterile abscesses. Urgent surgical evacuation and close monitoring for neurologic and renal functions as well as chelation (if toxicity is indicated) are key aspects of treatment. Education of the adverse effects and dangers of mercury is important, especially in pregnant women and children. As increased immigration changes demographic patterns, proper disposal of mercury and preventing its sale and use should become urgent societal priorities. Psychiatric consultation should be obtained whenever appropriate. *Key words:* case report, local abscesses, mercury injection, subcutaneous. *Environ Health Perspect* 112:1326–1328 (2004). doi:10.1289/ehp.6891 available via <http://dx.doi.org/> [Online 22 July 2004]

Case Presentation

Injection of elemental mercury is uncommon, and only 72 cases have been reported in the literature over the past 75 years. Of these 72 cases 46 were deliberate; most involved direct intravenous administration, usually with suicidal intent (Kayias 2003), or they were a complication of drug abuse. Bradberry et al. (1996) reported an attempted homicide by this means. Self-injection has also been reported in psychiatric patients (Soo et al. 2003), and accidental injections have been reported (Ellabban et al. 2003). Subcutaneous injection of mercury by accident (including injuries from broken thermometers), self-injection, and suicide attempts has been reported (Chodorowski et al. 1997; Ellabban et al. 2003; Smith et al. 1997; Soo et al. 2003).

A search in MEDLINE and PubMed (National Library of Medicine, Bethesda, MD) did not reveal any study or report on injection of mercury in the subcutaneous space of the hands for the sole purpose of preventing infections and "evil" during foreign travel. This practice is apparently common in several Central and South American countries. In this case report, I present such an injection received by a couple in Honduras before they traveled to the United States.

G.B., a 41-year-old Hispanic woman, and her partner, V.V., a 35-year-old Hispanic male, came to the clinic together. Both had wet towels wrapped around both their forearms and hands. They reported having pain for 5 days as well as swelling in the hands and low-grade subjective fever. The pain was localized to the dorsum of the hand and forearm, with no radiation, and was moderate in intensity and continuous, with no specific aggravating or relieving factors. The swelling and redness was localized to the same areas on the dorsum of the hand. They reported no history of bites or stings, and they had no swollen

glands or joint pain. A review of systems was otherwise negative.

Both patients gave a history of having received multiple injections of mercury at a roadside nonmedical facility in Honduras about 1 week before their clinic visit. They did not know about the sterility of the procedure or if needles/syringes used were disposable. On further questioning, they indicated that the injection of mercury is a common practice among people who wish to travel abroad. The reason for their injections was to ward off "evil" and also to protect against exposure to any unknown diseases while traveling in a foreign country. The patients estimated that the injections for both hands in both patients was < US\$1.00.

Both G.B. and V.V. denied any significant allergies or past medical history. They were both nonsmokers and denied alcohol or drug abuse.

A physical exam revealed G.B. to be an obese Hispanic woman in obvious distress due to pain in both hands and forearms. The general exam was unremarkable, and a local exam revealed a diffuse soft tissue swelling on the dorsum of both hands, with fluctuation, redness, and pointing (most prominent part of swelling in an abscess that marks the area of imminent rupture) in the first web space of both hands. Redness and swelling was also noted all along both forearms, with significant tenderness. No lymphadenopathy was noted. Lungs and heart were normal, and there was no renal angle tenderness and no hepatosplenomegaly. The neurologic exam was normal.

V.V. was a tall, medium-built Hispanic male in distress from pain. The general exam was unremarkable, and the local exam revealed findings similar to those for his partner, with fluctuation, redness, and tenderness in the dorsum of the hand and first web space

and in the forearms. Otherwise, the exam was unremarkable.

Laboratory values for G.B. were as follows: glucose, 101 mg/dL; blood urea nitrogen (BUN), 14 mg/dL; creatinine, 0.8 mg/dL; sodium, 138 mmol/L; potassium, 4.1 mmol/L; chloride, 105 mmol/L; carbon dioxide, 22 mmol/L; calcium, 9.5 mmol/L; liver function tests, normal; white blood cell (WBC) count, 8,700/ μ L; hemoglobin, 12.6 g/dL; hematocrit, 37.6%; urine mercury, 11.3 μ g/L; and serum mercury, < 5.0 μ g/L.

Laboratory values for V.V. were as follows: glucose, 108 mg/dL; BUN, 26 mg/dL, creatinine, 1.1 mg/dL; sodium, 138 mmol/L; potassium, 4.2 mmol/L; chloride, 97 mmol/L; carbon dioxide, 26 mmol/L; calcium, 10.2 mg/dL; liver function tests, normal except for alanine aminotransferase, 64 U/L (normal, 4–60 U/L); WBC count, 8,700/ μ L; hemoglobin, 16.0 g/dL; hematocrit, 48.3%; and blood mercury, 100 μ g/L (normal < 10 μ g/L). Urine mercury analysis was not performed because V.V.'s urine samples were lost by the laboratory.

A diagnosis of abscess was made, and both patients underwent incision drainage of both hands. Thick pus was evacuated along with beads of metallic mercury (Figures 1–3). Complete evacuation of all visible mercury, about 0.5 mL, was performed and wounds were thoroughly washed with copious amounts of saline. The fluid removed was sterile pus (result of milder inflammation caused by irritants, foreign bodies, etc., but not due to infection). The soaked gauze and dirty sheets were disposed in regular waste.

Postoperatively, the wounds granulated and healed well by secondary intention (left open to heal by epithelization). Since that time, the patients have been lost to follow-up.

Discussion

Mercury is sold as "azogue" in religious stores, or botanicas, for use in Esperitismo (spiritual belief in Puerto Rico), Santeria (Cuban practices), and voodoo. The mercury is often carried personally in a pouch or spread around the house or bed, mixed in the bath, or burned in devotional candles. Mexican-Americans take it orally to relieve *empacho*

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The author declares he has no competing financial interests.

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(indigestion), especially in infants and children. Mercury is difficult to remove, and it can remain in carpets, walls, and homes for long periods.

The form of mercury consumed in fish is mainly methyl mercury, and mercury from occupational and dental exposure is elemental mercury. Both forms are absorbed and can have serious consequences (Magos 1997).

Concerns about mercury contamination have been growing in predominantly Hispanic and Caribbean neighborhoods. In New York City, neurotoxic levels of mercury vapor from magicoreligious and ethnomedical uses of mercury have been reported (Wendroff AP, personal communication). Wastewater samples from a residential neighborhood in Washington Heights had highly elevated mercury levels on two occasions. Secondhand exposure from previous tenants sprinkling mercury on floors also remains a problem because the contamination can remain for over a decade. Mercury exposures resulting from magicoreligious use are often greater than those occurring by eating fish or from dental amalgams (Wendroff AP, personal communication).

In a survey at the Montefiore Medical Center in New York in 1996, Zayas and Ozuah (1996) studied the sales of mercury in the Bronx area of New York City. Of the 41 botanicas they located, 38 sold elemental mercury; in 1995, 35 of the 38 botanicas sold about 25,000–155,000 capsules or vials (mean weight, 9 g) for spiritual practices. Of the users, 29.3% said that it was “sprinkled in the home” (Zayas and Ozuah 1996).

In an effort to raise the awareness among pediatricians about the possibility of toxic

exposure to mercury in children, Goldman (2001) reported on the use of mercury in Santeria among immigrants from Haiti and other Caribbean nations, in which elemental mercury was sprinkled around the house. Riley et al. (2001) reported a 5% prevalence of elevated mercury levels in urine of 100 children in Bronx, New York, in August 2001. Of these children, 55% were Latino and 43% were African American (Riley et al. 2001).

In a study in Massachusetts, 898 people were surveyed in the Lawrence area, which has significant Latino and Caribbean populations (JSI Center for Environmental Health Studies 2003). The survey showed that 91 people swallowed mercury in a drink, 143 applied it to their skin, 152 burned it in candles, and 108 sprinkled it around their homes. The study authors estimated that a minimum of 6.8 lb of mercury had been released into the community through magicoreligious use. Forty percent of the Latinos in the Lawrence area knew about azogue or used it themselves. The authors were especially concerned about the large number of apartments that may have been severely contaminated.

Attempts by power companies to replace pressure-control devices for domestic gas supply has led to mercury spills, affecting 200,000 homes in one incident (Clarkson et al. 2003). High levels of mercury exposure can result from sprinkling mercury on the floor of a home or car, burning it in a candle, and mixing it with perfume. Because mercury vapor is heavy and tends to form layers close to the ground, infants and children, whose breathing zones are closest to the floor, are at highest risk. Ingested mercury passes through the gut unabsorbed. For centuries it has been

used to treat constipation (Clarkson et al. 2003).

In Latin American and Central American countries, mercury is dispensed in small centers for psychic readings and in fortune telling stores, usually not a medical establishment. The entire process is very ritualistic. Clients are often requested to bathe and then have eggs smeared over their bodies. Of the various indigenous herbs and heavy metals used for treatment, mercury is popular; it is often consumed in a mixture of port wine, eggs, nutmeg, and milk. In many South American countries, mercury is often administered by intravenous injection to help athletes and boxers build muscle mass, a practice based on superstition (Smith et al. 1997).

The oral route of metallic mercury use does not cause poisoning symptoms, but its use in infants and children could cause subclinical developmental problems. Concentrations in blood and urine after ingestion of mercury remain low because very little is absorbed. However, mercury injected subcutaneously causes sterile, inflammatory, and necrotic reactions resulting in abscesses and granulomas. Environmental and occupational exposure to mercury can be determined by measuring toenail mercury levels (Garland et al. 1993; MacIntosh et al. 1997; Yoshizawa et al. 2002).

Intra-arterial injection can cause digital ischemia and/or gangrene secondary to embolization. One case of cardiac granuloma secondary to intra-arterial injection has been reported (Kedziora and Duflou 1995). When mercury is injected intravenously, it goes mainly to the lungs and can cross over to systemic circulation (Givica-Perez et al. 2001).



Figure 1. Incision made in hand of V.V. shows mercury pellets inside the incision and the inflammation of the injection site.



Figure 2. Incision site of V.V.'s hand before irrigation.



Figure 3. Significant amount of mercury pellets spilled during irrigation of the incision in V.V.'s hand.

Cases of foreign body granuloma on the thumbs or hands have been reported after rubbing mercurial ointments (Bradberry et al. 1996). In cases of subcutaneous metallic mercury injection, patients usually present weeks to months later with an inflammatory mass at the site of injection. The diagnosis may be apparent on X-ray examination or it may be obvious at the time of surgery (Bradberry et al. 1996).

Patients may be seen remote from the mercury exposure with swelling at the injection site. Pathologic findings of granuloma, fibrosis, and histiocytes suggest a local foreign-body-type reaction to metallic mercury. Abnormal serum levels suggest that there is some lymphatic and vascular migration following subcutaneous injection (Soo et al. 2003).

Mercury can be detected by imaging X rays or ultrasound. In the case of a 32-year-old nurse who had cut the palm of her right hand with a broken thermometer 30 days earlier, sonography showed multiple small echogenic dots surrounded by a hypoechoic halo, suggesting the presence of small crystal fragments or droplets of mercury (Romero et al. 2004). No reverberation, acoustic shadowing, or flow on color or power Doppler imaging was noted. Mercury is hyperechoic on sonograms despite being liquid at room temperature. It is a safe, inexpensive, portable, and readily available imaging modality (Romero et al. 2004). Two deaths have been reported following subcutaneous injection (Chodorowski et al. 1997); cause of death was renal failure in one patient and empyema in the lung of the second patient.

There is no ban on the sale of mercury, although the Federal Hazardous Substances Act (1994) mandates that it be sold only with an attached warning label. Current U.S. public

advice on disposal of mercury is confusing and inconsistent; 45% of requests for advice from local and state waste management centers resulted in advice to use regular household collections to dispose thermometers (DiCarlo et al. 2002).

Under a voluntary agreement between the U.S. Environmental Protection Agency (EPA), the American Hospital Association, Hospitals for a Healthy Environment (H2E) was formed. A pledge was made to eliminate mercury, identify pollution prevention opportunities, and reduce waste. As of March 2002, the H2E had as partners 260 hospitals, 36 clinics, 8 nursing homes, and 25 other facilities across the United States (Wendroff A, personal communication). Information on the safe disposal of mercury is available on the U.S. EPA website (U.S. EPA 2004).

With changes in demographic and population ethnic mixes, controlling the sale of mercury and ensuring its proper disposal become more urgent. Serious environmental contamination and long-term consequences could otherwise cause severe consequences in the future.

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fellowship focus

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

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I chose the oft-maligned Superfund program of the Environmental Protection Agency (EPA) for my placement as an AAAS Environmental Fellow. It was a pleasant surprise to find it was a truly functional work environment; everyone I worked with was dedicated to the job and maintained a healthy balance between the lofty idealism that drew them to public service and the skeptical realism required to survive in Washington. There were a lot of good ideas in the office, and I quickly learned that the devil is in the details of implementation. With that in mind, I wanted to become a valuable source of input.

For one of my Superfund assignments, I worked with an anthropologist-turned citizen activist named Arnold Wendroff, who has dedicated the last 10 years to hounding government agencies into addressing his concern that many Latino and Caribbean children are exposed to high

• **I gained 'street credibility' for teaching my course in engineering and public policy at Smith College.**

levels of mercury vapor in their home environments, as the result of traditional cultural practices. An excellent case of "one person making a difference," Wendroff's lone voice has brought significant attention to a rather obscure issue. I documented what was known about these types of exposures, and consulted with EPA about risk management

approaches. I also met with key Latino leaders in Washington and organized a two-day workshop with panels of community health and cultural experts. I learned how a certain wariness exists within immigrant communities regarding the federal government and that keeping a low profile is the best way to address this issue. The experts believed federal action should focus on the sharing of information among communities, and providing resources to local groups.

As an expert on mercury in indoor air, I also consulted with others at EPA on their protocol for measuring mercury vapor indoors and responding to contamination. The agency would not agree to a single justifiable level for remedial action, arguing that it would depend on who lived in the dwelling. I disagreed with this position because mercury's residence times are so long that one cannot guarantee that the same dwelling will not be occupied by a pregnant woman or infant in coming years, which would warrant a stricter clean-up standard. Keeping everything on a "case by case" basis allows EPA to operate at stricter cleaning standards without drawing too much attention from industry groups with greater muscle in Congress. I came to the conclusion that flexibility, while it may draw criticism for not ensuring equitable treat-

ment, is its own form of power and provides more wiggle room for EPA. In the current administration, this would mean more room to be protective of the environment.

I also learned that information can sometimes be decentralized and available only through knowing the right person to ask. This information network I developed during my year as an AAAS Environmental Fellow has been extremely useful to me during my recent return to academe. Not only have I gained "street credibility" for teaching my course in engineering and public policy at Smith College, but also I can assist my students in learning how to navigate bureaucracies for themselves — an essential skill for them to have as researchers and, perhaps more importantly, as citizens.

by Donna Riley

Donna Riley served as an Environmental Fellow from 2000 to 2001. She received a PhD in Engineering and Public Policy from Carnegie Mellon University and currently is an assistant professor at Smith College.

Director's Corner

April 2002 >>> The AAAS Fellows currently serving at the Environmental Protection Agency (EPA) include engineers, ecologists, botanists, toxicologists, a biochemist and a political scientist. This diversity has a broad impact on EPA. The Fellows are involved in such projects as coral bleaching, regulating chemicals that disrupt endocrine systems and technologies that may assess future environmental problems. **If you would be interested in having former Fellows speak with a group on your campus about this or other AAAS policy fellowship programs, please contact us at 202/326-6700.**

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Assessing Elemental Mercury Vapor Exposure from Cultural and Religious Practices

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Use of elemental mercury in certain cultural and religious practices can cause high exposures to mercury vapor. Uses include sprinkling mercury on the floor of a home or car, burning it in a candle, and mixing it with perfume. Some uses can produce indoor air mercury concentrations one or two orders of magnitude above occupational exposure limits. Exposures resulting from other uses, such as infrequent use of a small bead of mercury, could be well below currently recognized risk levels. Metallic mercury is available at almost all of the 15 botanicas visited in New York, New Jersey, and Pennsylvania, but botanica personnel often deny having mercury for sale when approached by outsiders to these religious and cultural traditions. Actions by public health authorities have driven the mercury trade underground in some locations. Interviews indicate that mercury users are aware that mercury is hazardous, but are not aware of the inhalation exposure risk. We argue against a crackdown by health authorities because it could drive the practices further underground, because high-risk practices may be rare, and because uninformed government intervention could have unfortunate political and civic side effects for some Caribbean and Latin American immigrant groups. We recommend an outreach and education program involving religious and community leaders, botanica personnel, and other mercury users. **Key words:** cultural, exposure, mercury, religious, Santeria. *Environ Health Perspect* 109:779–784 (2001). [Online 1 August 2001]

<http://ehpnet1.niehs.nih.gov/docs/2001/109p779-784riley/abstract.html>

In the United States, certain Afro-Caribbean and Latin American traditions, including Santeria, Palo, voodoo, and Espiritismo, incorporate the use of elemental mercury in folk medicine and religious practice. Mercury is sold in most botanicas—stores specializing in herbal remedies and religious items used in these traditions (1,2). Its use in small, enclosed spaces and the long residence time of elemental mercury create the potential for very high direct exposures to individuals.

Although these religious traditions have been well studied by anthropologists and sociologists (3–7), mercury use and the hazards it poses to practitioners have not been a focus of this work. Popular books for home practitioners of Santeria (8,9) include spells that use mercury, but do not comment on the risks it poses. Medical anthropologists have documented the use of potentially toxic remedies in folk medicine, but have not focused on the health implications of toxic substances used in religious rituals and spells (10,11).

Availability and extent of use. Several surveys have attempted to characterize mercury use in Latino/a and Afro-Caribbean communities. In a survey of New York City botanicas, 93% reported selling elemental mercury (about one to four capsules per day) (2). A survey of 115 botanicas in 13 cities in the United States and Puerto Rico found that 99 sold mercury (1). Johnson (12) surveyed 203 Caribbean and Latin American adults in the New York City area; 44% of Caribbean and 27% of Latin American respondents

reported using mercury. However, a study of Santeria practitioners in the Hartford, Connecticut, Hispanic community done by the Agency for Toxic Substances and Disease Registry [ATSDR (13)] found only 14% reported using mercury in the home. The Hartford study was limited to practitioners of Santeria, a Cuban syncretic religion combining elements of Catholicism and the African Yoruba religion. Santeria is somewhat stigmatized and practiced covertly because of its long history of oppression in Cuba and conflict over animal sacrifice rituals in the United States (3). Johnson (12) looked more generally at folk medicine and religious and cultural practices, finding mercury use outside of Santeria; similarly, Zayas and Ozuah (2) found that Santeros (Santeria priests) were mentioned by store proprietors as the source of mercury recommendations less than 10% of the time.

Although there are no clinical studies of this population of mercury users, a recent study (14) found a 3% prevalence rate of elevated mercury levels (> 10 mg/L) in the urine of 100 children in the Bronx, New York. This rate, found among a cohort that was 55% Latino/a and 43% African-American, is comparable to the occurrence of elevated blood lead levels in similar populations, and is therefore of significant concern (14).

Uses. Mercury is typically sold in capsules that contain, on average, about 8 or 9 g (0.3 oz.) mercury (1). The most common method of use reported by botanica personnel was to

carry mercury on the person in a sealed pouch (49%) or in a pocket (32%) as an amulet; sprinkling mercury in the home was mentioned by 29%. Proprietors reported that family members, friends, spiritualists, and card readers recommend mercury to store patrons to bring luck in love, money, or health and to ward off evil (2). A survey of Latin American and Caribbean New York residents (12) found that burning mercury in a candle, mixing it with perfume, and sprinkling it in the car were also frequently reported uses. Of 28 New York botanicas visited during another survey (1), 13 prescribed sprinkling mercury on the floor. Mercury poisoning has also been documented in Mexican-American infants fed mercury as a folk remedy for gastroenteritis (15). Medical anthropologist Robert Trotter identified the use of mercury, as well as lead oxides, for the treatment of *empacho*, a culturally bound digestive illness (16).

Impacts. As a result of these practices, living spaces may become contaminated with mercury. Removal of elemental mercury from floorboards and carpets is difficult, if not completely impractical (17). These mercury practices can be a direct source of contamination not only in the users, but also in their families, people living in adjacent apartments, and any future residents of the premises. The potential liability to present and future landlords is significant, because current and prospective homeowners may raise concerns about health risks related to prior mercury use on the premises. In addition, much of the mercury used in folk medicine and religious practice may be disposed of improperly. Johnson (12) found that 64% of mercury users in his study reported throwing mercury in the garbage, 27% flushed it down the toilet, and 9% threw it outdoors.

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Sources. The wholesale sources of elemental mercury remain difficult to discern. Because the sale of mercury is not regulated in this country (although the labeling is), it could come from a number of sources.

In its initial investigation of mercury use in 1993 (18), the U.S. Environmental Protection Agency (U.S. EPA) Office of Enforcement learned that Los Angeles area botanicas, as well as retail establishments in other areas of the country, obtained mercury from a metal recycler based in U.S. Region II (New York/New Jersey area). U.S. EPA reported that this company sells a very small percentage (the exact numbers were not specified in the report) of its recovered mercury to religious supply companies throughout the country; these companies repackage and redistribute mercury, along with other religious articles, to small businesses (e.g., religious stores and candle shops) (18). Whether this is still the case in 2001 is unclear, but one botanica worker told us during our field research that the store acquired its mercury from a community member in an unlabeled truck, suggesting a less formal relationship. Several botanicas we visited poured mercury from a large container into a gelatin capsule or small bottle in front of us, often spilling it. It is reasonable to suspect that in establishments where mercury is bought pre-encapsulated, some workers either in that botanica or in a wholesaler are following similar practices, which could cause significant occupational exposures.

Botanica Field Research

The collection of qualitative data helps researchers understand how a society's belief systems are constructed and how those beliefs are legitimized. Using traditional fieldwork approaches in anthropology and sociology (observation and participant observation), we sought to understand the social, political, and cultural contexts that surround cultural and religious uses of mercury. We also attempted to understand respondents' views on mercury's "magical" properties. We visited 15 botanicas in New Jersey, New York, and Pennsylvania and engaged in conversations with the personnel there about mercury and its uses.

Our initial approach was to enlist the participation of botanica personnel in recruiting subjects for interviews. Two of us, who are white, non-Hispanic women, traveled to botanicas in Jersey City, Union City, and Passaic, New Jersey, and offered to purchase a \$10 gift certificate or store credit for every botanica customer who participated in a 20-min interview conducted at or near the botanica. However, we found that botanica personnel were wary and untrusting of us as researchers. Despite university credentials

and a detailed explanation of the study, personnel at every botanica we visited denied selling mercury. Some told us it was illegal to sell mercury, some told us that they used to sell it but no longer do because it is dangerous, and some said they simply didn't want any trouble. At the same time as botanica owners and employees denied selling mercury, they affirmed that people did use it and that store patrons requested it specifically. Possible trouble with authorities was mentioned by workers at all northern New Jersey botanicas. When asked what they meant by trouble, most were vague and said that law enforcement authorities were "cracking down." No one mentioned a specific instance of a botanica having problems with the law—just that they had heard that it was happening.

Several factors affect immigrants' willingness to participate in interviews or even to provide information to social researchers. Anti-immigrant sentiment (both real and perceived) makes possible respondents wary of outsiders, especially those who may be seen as representing authority. This difficulty may be exacerbated in urban areas where immigrant group solidarity is reinforced through differences in cultural knowledge between insiders and outsiders. To the extent that a group uses racial and ethnic markers to determine inclusion or exclusion, researchers who are not group members may find themselves excluded automatically.

One week after our first attempt, a member of our research team who is an Afro-Cuban Santero returned to these botanicas by himself and was able to purchase mercury in all but one establishment (Figure 1). Some shared with him the fact that "inspectors" had been by (the same day that the first two researchers visited, so this may have been a reference to them), and they expressed concern about trouble from the authorities. Some of these botanicas sold mercury directly, whereas others used more clandestine approaches, such as sending the researcher to a private home or offering to meet him later with some mercury from a "personal stash." Even those that sold directly were surreptitious about the location of mercury in the store, keeping it out of plain sight and in some cases obscuring the location from the purchaser.

This climate of caution in northern New Jersey may relate to activities of the New York City Health Department in trying to educate botanicas in the city about the need to label mercury. The Health Department's program currently is extremely cautious, comprised of a letter explaining to botanica owners that they may sell mercury but must abide by labeling regulations (19), and of visits by health inspectors that involve observation only, with no violations issued or remedial actions taken (20). Despite this

reserved approach, rumors of investigations by various inspectors were prevalent in that area, making the sale of mercury more of an insider activity.

Outside northern New Jersey, it was much easier to purchase mercury. In central New Jersey, a trip by all three researchers to a local botanica revealed a much freer attitude about the substance. The mercury was stored in plain sight on a shelf behind a glass case, and the shopkeeper pulled out a glass jar containing approximately 4 lb mercury. Without using any kind of dropper, the shopkeeper poured mercury from the jar into a gelcap, with almost as much mercury overflowing onto the counter, beading and rolling onto the floor. The shopkeeper swept the remaining mercury back into the bottle with her bare hand. This botanica worker suggested several uses of mercury that were consistent with those in the literature, including sprinkling it indoors, mixing it with face cream, and burning it in a candle. Botanicas in Philadelphia were somewhat reluctant to sell mercury, but it was far easier to obtain than in northern New Jersey. A botanica worker in North Philadelphia poured approximately 50 g into a small jar for sale to the Santero researcher (shown in Figure 1). A different establishment in the same area poured it into a small zip-lock bag (also shown in Figure 1), because they were out of gelcaps. Although the owner of another central New Jersey botanica did not have mercury on hand, he volunteered to get some for one of the non-Hispanic researchers before her next visit to his shop.

A trip to a pagan/New Age spirituality store in New Hope, Pennsylvania, revealed that the use of mercury extends beyond Latino/a or Caribbean culture. A shopkeeper there told all three researchers that pagan traditions of European origin include filling a hollowed out nutmeg with mercury as a good luck charm. This shopkeeper did not have mercury readily available, but offered to travel to a botanica in New Jersey or Pennsylvania to order it for us.

In addition, we held conversations with *babalawos* (Santeria high priests) in Jersey



Figure 1. Containers of elemental mercury purchased at botanicas in New Jersey, New York, and Pennsylvania include gelcaps (weighing 10.8 g, 12.5 g, 7.4 g, and 9.3 g), jar, reused perfume bottle (teflon seal added after purchase), and plastic zip-lock bag.

City, New Jersey and Miami, Florida about how they prescribe mercury. The *babalawos* acknowledged the ready availability of mercury and expressed some concerns about the safety of its use by individuals. One said he prescribed mercury only for outdoor use. Both said that it was a spiritually powerful substance that should be used only to resolve more serious problems.

Despite the difficulties, this preliminary research provides several insights. Future research will demand careful attention to developing rapport and establishing relationships with respondents. Government efforts of the recent past have only made current and future work in the community more difficult. To the extent that there are (or people believe there are) negative repercussions for botanicas that sell mercury, a closed community becomes even more closed. The combination of racial and ethnic, religious, immigrant, and regulatory factors interact to make data collection—or preventive outreach activities by outsiders—extremely difficult.

The contrast between the interactions of botanica personnel with the non-Hispanic white researchers and those with the Afro-Cuban Santero researcher is stark. In areas where community members are wary of repercussions, researchers must work with a relative “insider.” Several botanica personnel commented to the Santero researcher that although they had to be cautious, they would sell him mercury because he was an Afro-Cuban Santero and they understood that he had a legitimate need.

Interviews with Mercury Users

We recruited individual mercury users for interviews intended to reveal how they use it, what benefits it brings them, and what they believe the risks are, if any. Knowing that cultural uses of mercury do carry some social stigma, we sought to minimize normative expectation effects by using an open-ended, structured interview, designed to capture individuals’ beliefs about mercury use (21,22).

We recruited subjects on the Internet and through newspaper advertisements; they received \$10 compensation for participating in 20-min interviews, for which they gave prior informed consent. Response was low, reinforcing the need for ethnographic approaches that reach this small target community and cross-cultural barriers more effectively. Nevertheless, the three interviews we were able to conduct illustrate a wide range of self-reported uses of mercury in a variety of cultural and religious traditions, with a range of possible exposure patterns. Here we describe two of the interviews, which present cases of high exposure and low exposure.

Subject 1. The first subject described playing with mercury as a child, and reported that 30 years later, in 1997, he “went to Cuba and I converted religions and I began using it in a religious and magical way.” He distinguished between elemental mercury and *precipitado rojo*, which he said is mercuric oxide. He said he used one or the other form of mercury about once a week, typically mercuric oxide. When asked about the benefits of mercury, he said, “mercury is used as a magical and religious thing. What it does is it speeds up magical spells. And it allows spirits to travel over water.”

He described a secondary practice he learned in Mexico City, where mercury is sold in small vials sealed with wax, for people to wear around their neck. He said he didn’t know “what they do magically,” but he hypothesized that “They might make a person’s mind quicker, you know, the association like quicksilver—the mind is quick.”

This subject’s primary use of elemental mercury was in birthing a *prenda*.

Prenda is in the Palo religion. It’s like a big cauldron. And it has a spirit in it. And to start the *prenda* you need to put at least a kilo of mercury in there. That’s when you first begin, along with a lot of other things. OK a lot of other things. One of the things that goes in there is like a *kilo de azogue* [a Spanish word for mercury]. And so it goes in there. That’s the very first thing. Then as you go along sometimes your *prenda* will ask for more mercury. Sometimes you’ll be doing a spell and you’ll need the spirit to move across water. And then you need mercury.

When asked if he would recommend mercury to a friend, he said it depended on the person and the proposed use. “Mercury is extremely poisonous and extremely toxic. Bad for people and bad for the environment.” When probed further about concerns people have about mercury, he added, “It’s like mercury is a heavy metal. It’s like mercury is an extremely toxic metal. So yeah. And you know it’s like lead in paint, there are all sorts of problems with mercury.” He said he did not know any specific symptoms that can result from mercury use, “But I know that death is one and madness is another, like mad as a hatter. They used to use mercury to [make?] felt hats so madness is probably one of the symptoms, I hope you don’t think I’m mad.” When asked how he became aware of his concerns, he said, “Well, I don’t know. Everybody knows about it.”

When asked what actions he took in response to his concerns, he said he didn’t feel he had to, because “I don’t deal that much with mercury.” He did raise concerns about disposal of mercuric oxide other than pouring it down the drain. He added, “The one concern that I do take is I don’t touch the powder and I don’t touch mercury itself

with my hand, I don’t taste it. So that’s the precaution I guess I take now because I know mercury’s toxic but I didn’t take as a child, so I guess I do take that precaution.”

Subject 2. Subject 2 was a 58-year-old Caucasian male who said he currently used mercury in magic, and also had played with it as a child. He said he used mercury once every 2 or 3 months. He said he used mercury as “an expediter” and primarily in the form of red mercuric oxide. “Basically it’s a good expediter in speeding up the action of a spell.” He said he learned magic in a school in New York in the 1970s and described mercury’s mode of action as follows: “Mercury is a symbolism of the planet Mercury which is the messenger. . . . in Greco-Roman [tradition] it relates to Mercury or Hermes. OK. But basically it’s a speeder of communications, ease of communications or communications spells, to make them pass into the subconscious mind of the person you’re doing the spell on faster.”

When asked about other uses, he shared some knowledge of Santeria and Palo, and of its use in folk medicine.

I know people use it for ulcer medication which I think is a little dense. For, like a stomachic? And they take it in a capsule form, but I don’t think that’s a very good thing. . . . [Interviewer asks why] Well, mercury’s toxic. And there’s a problem with taking anything like that internally. The other thing is when you have a toxic thing internally, mercury is a cumulative toxin that causes cavitation of the brain. And so as a result, people get a little stupid when they take mercury. Are you familiar with the phrase mad as a hatter? . . . then you know what happens to people who use a lot of mercury.

He said that “practically every magician I know uses it.” When asked if there were alternative products that brought the same benefits as mercury, he said it depends on the type of spell, but that “celery seed is a vegetable expediter” that works well, but not as well as mercury.

He said he bought a kilogram of mercury in New York City in the 1970s and that he is still working on the same quantity. He reported keeping it in a shatter-proof glass container with a teflon seal. He said he used one small drop at a time, and described two spells, one against thievery and one to promote talking.

Both spells involved putting one drop of mercury, about one-eighth inch in diameter, roughly 0.25 g, dispensed with an eyedropper, in a bottle with a narrow neck, covering it with holy water and other ingredients (feathers or ashes). The bottle is sealed with paraffin and put in a window or corner of the room (30 ft × 18 ft, no open windows or doors).

He said that the spells are typically disassembled after a week or two and that he salvages the mercury and reuses it in future spells.

"I use the same mercury over and over again. That's why I still have most of what I bought."

When asked about concerns around mercury use, he said,

Many people are concerned it plays havoc with your mentation. And as long as I've been using it I've been in MENSA or was in MENSA for about 20 years right after they first started it and I just stopped paying my dues so I don't belong to it any more but I don't think it ever hurt my mentation.

When asked specifically about health effects, he said,

Well, you know, I don't eat it, so I don't think it would be so bad, you know I wouldn't be too concerned about it.... You know, it rots your brain if you get too much of it in.

He described his precautionary behavior as follows:

Well I use a medicine dropper to move it around. Sometimes I use a spoon if I'm going to give somebody some, and I have a plastic impermeable spoon for that that I do that with, I do that with other things too.

Exposure Assessment

The literature on indoor air-quality modeling does not include models for characterizing the fate and transport of mercury vapor in homes, despite literature documenting cases of mercury vapor poisoning in indoor air, primarily from accidental spills (23–27). However, an extensive literature on modeling indoor air quality for volatile organic compounds can be built upon to estimate the fate and transport of mercury vapor indoors (28–32). An unpublished paper modeling the breakage of a common household fever thermometer (33) provides some relevant examples for modeling indoor concentrations of mercury vapor. Perhaps the most relevant work was done by the U.S. EPA's (18) adaptation of its Multi-Chamber Concentration and Exposure Model for cultural uses of mercury. The risk assessment estimated exposure for two scenarios, one in which mercury is burned in a candle and another in which mercury is sprinkled twice a week in a child's crib for 2 years.

An accurate and detailed assessment of the fate and transport of mercury vapor inside a house, including adsorption and desorption behavior, is complex and case-specific, and requires data for a variety of variables such as the surface area of exposed mercury as well as adsorption and desorption characteristics. Lacking these data, we use simple models and laboratory experiments to provide an order-of-magnitude estimate of exposures that could result from cultural uses of mercury. Although use of both elemental mercury and mercuric oxide has been reported, the calculations are for elemental

mercury because it is significantly more volatile than mercuric oxide (34).

A simple box model can provide an estimate of potential mercury vapor concentrations:

$$V dC/dt = S - QC, \quad [1]$$

where V is the room volume (cubic meters), C the concentration of mercury (micrograms per cubic meter), S the rate of mercury evaporation (micrograms per hour), and Q the air flow rate from the room (cubic meters per hour; the room volume times the number of air changes per hour). Assuming an initial mercury vapor concentration of zero, Equation 1 has the solution

$$C(t) = S/Q(1 - e^{-Qt/V}). \quad [2]$$

The mercury evaporation rate S is the rate of mercury volatilization per unit area of mercury, which is $7 \mu\text{g}/\text{cm}^2/\text{hr}$ at 20°C (35), times the surface area of exposed mercury. In this model, the equilibrium concentration is approached after several times the characteristic time V/Q , which is simply the number of hours per air exchange, typically 2 hr (36). The equilibrium concentration is S/Q .

The mercury vapor concentrations in our estimates can be compared with a number of health standards. The ATSDR's minimal risk level is $0.2 \mu\text{g}/\text{m}^3$, which is an estimate of the daily human exposure that is likely to be without appreciable risk (37). Occupational exposures can be considerably higher: The U.S. Occupational Health and Safety Administration's maximum ceiling concentration is $100 \text{ mg}/\text{m}^3$ (38). The U.S. National Institute of Occupational Safety and Health sets its 8-hr time-weighted average (TWA) recommended exposure limit at $50 \mu\text{g}/\text{m}^3$ (39). In 1994 the World Health Organization reduced its exposure limit for total inorganic mercury to $25 \mu\text{g}/\text{m}^3$, and the American Conference of Government Industrial Hygienists set its maximum 8-hr TWA concentration at $25 \mu\text{g}/\text{m}^3$ (40).

Subject 1 reported keeping a kilogram of mercury in a cauldron (*prenda*) in a 43 m^3 room. Although in the Palo religion this vessel is typically sealed, the subject did not report sealing it. Assuming the cauldron is 25 cm in diameter and that the air exchange rate in the room is 0.5 air changes/hr, the equilibrium concentration is on the order of $600 \mu\text{g}/\text{m}^3$, which exceeds occupational exposure limits by an order of magnitude.

Subject 2 reported keeping mercury in a sealed bottle and removing only small amounts for use. The room volume was an estimated 180 m^3 . Assuming a small open bottle containing only 0.25 g of mercury in a single droplet, Equation 2 indicates that

the mercury vapor levels would be on the order of $0.02 \mu\text{g}/\text{m}^3$, an order of magnitude less than the ATSDR's minimal risk level.

Applying Equation 2 to a hypothetical scenario in which a typical 9 g capsule of mercury is broken in a typical living room of 40 m^3 , we assume an air exchange rate of 0.5 air changes per hour and an average droplet diameter of 1 mm. The concentration of mercury equilibrates at about $7 \mu\text{g}/\text{m}^3$, an order of magnitude higher than the ATSDR's minimal risk level, but an order of magnitude less than the occupational exposure limits. This exposure could be significantly higher and could continue for a number of years if mercury capsules are dispersed about the house regularly.

These estimates are consistent with measurements of indoor air mercury levels after mercury spills. In 1989 two children developed acute mercury poisoning, and mercury vapor levels of $50\text{--}400 \mu\text{g}/\text{m}^3$ were found in their apartment (24). It was discovered that the previous tenant of their apartment had, several months earlier, spilled a large jar of mercury (24). In another incident, a spill of about 300 g of mercury produced indoor air mercury concentrations of $10\text{--}40 \mu\text{g}/\text{m}^3$ several months after the spill, and a child was acutely poisoned (25). Breakage of a clinical thermometer onto a vinyl kitchen floor, followed by a clean-up of all visible mercury beads, produced mercury vapor levels throughout the house of about $5 \mu\text{g}/\text{m}^3$ a week after the spill. That level fell to about $0\text{--}2 \mu\text{g}/\text{m}^3$ 2 weeks after the spill (17).

The act of burning of mercury in a candle has been reported by several sources (8,9,12) and in our field research. The high temperatures of the flame and even the melted candle wax would, upon initial examination, be expected to increase significantly the volatilization rate for mercury. The U.S. EPA estimated a maximum air concentration of $2,000 \mu\text{g}/\text{m}^3$ for a mercury-in-candle scenario (18), assuming total volatilization of 4 g of mercury in 1 min in a 27 m^3 room.

Our experiments indicate that such rapid volatilization is improbable, because mercury sinks into the candle wax and becomes trapped. Small amounts (3–12 g) of mercury were weighed out and placed in 14 tealight candles, which burned for 1 hr. At the end of this time, the candles were extinguished, and after cooling, the candle was lifted out of the tealight casing to retrieve the mercury that had sunk to the bottom of the candle. The retrieved mercury was reweighed. Figure 2 illustrates our experimental results, with losses averaging $0.09 \text{ g}/\text{candle}$. There is a systematic error caused by the possible loss of mercury in the retrieval, accounting for as much as 0.1 g of the measured losses.

Our experiments certainly rule out the volatilization of a large fraction of the mercury, contrary to the U.S. EPA. However, our data do not rule out the possibility that as much as about 0.05 g of mercury is volatilized when mercury is poured into a candle. This is at least two orders of magnitude higher than what would be volatilized at room temperature. Thus, we cannot rule out the possibility that burning mercury in a candle indoors could cause significant exposures to mercury vapor, much higher than those encountered by sprinkling mercury at room temperature.

The results of our simple models indicate that mercury exposures from some cultural uses of mercury may be below the level of health concern, but that dangerously high mercury levels could develop in a home if large amounts, high temperatures, or frequent activities are involved.

The greatest source of uncertainty in our estimates rests with the choice of a volatilization rate for mercury, which depends on temperature and droplet size (surface area). In many cases the order of magnitude of the droplet radius determines the order of magnitude of the mercury exposure, and thus is a most critical factor, which is likely to vary greatly from use to use. For example, an average droplet diameter of 1 mm was assumed in the capsule-sprinkling scenario. Average droplet size can be as small as 0.1 mm in diameter, which greatly increases the amount of mercury that can volatilize through increased surface area. Other important factors such as temperature, oxidation, and settling of dust and other particles can each affect the volatilization rate as well as the adsorption and desorption rates.

Recommendations

Our interviews, field research, and modeling show potential for cultural mercury uses to produce high exposures to mercury, and for long-term exposures that could adversely affect children living in contaminated buildings.

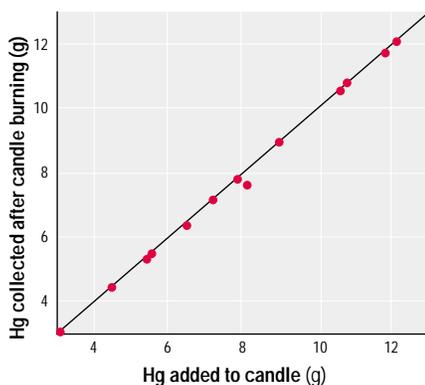


Figure 2. Mass of mercury after burning candle versus mass of mercury placed in candle.

However, we also show that infrequent practices with small amounts are not likely to pose a health hazard. It is therefore imperative that we develop a better understanding of the extent of different uses and their likely impacts on mercury air concentrations in residences. We are concerned about people's right to know if their residence is contaminated with mercury, even at relatively low levels. Finally, because our interviews showed a lack of understanding about mercury volatilization and inhalation as a route of exposure, there is an opportunity to reduce risk through community outreach and communication, with minimal interference in people's religious beliefs and cultural traditions.

Better understandings of extent of different uses. Our interviews and fieldwork indicate that mercury is used in a variety of ways by many different kinds of people. How mercury is used greatly affects the likely exposures that can result. It is imperative that social science researchers work with natural scientists to understand the prevalence rates of different mercury practices, and then relate reported or observed behaviors to exposures and health consequences, using predictive models.

Public policy. The policy implications of this work span a variety of topics from immigrant experience in the United States to labeling regulations for the sale of toxic substances to First Amendment freedoms. A key issue for regulators is the closed nature of the community. Visitors from outside the group (e.g., health inspectors) will very likely be told what they want to hear, which is: no *azogue* [mercury] here! The stricter the enforcement actions, the further underground mercury sales and use will go. Although this may reduce mercury exposure in botanicas, it may not have a significant effect on home use and thus on exposure.

Although it is currently legal to sell mercury in any environment, there are labeling requirements that should be followed—and typically are not followed in botanicas. The Consumer Product Safety Commission (CPSC) is charged with enforcing these regulations under the Federal Hazardous Substances Act (19). The CPSC, however, is notoriously underresourced, with six inspectors charged with enforcing all product regulations for over 15,000 types of products in New York City, Long Island, and northern New Jersey. Therefore, its enforcement efforts have focused on the suppliers of mercury, warning chemical companies that if they sell to botanicas or other entities that sell mercury to consumers, they must ensure those products are labeled for retail (41). The New York City Health Department has sent a similar letter to all

local botanicas explaining these labeling regulations as well as its own ordinances.

Further enforcement action would require inspectors to visit botanicas. Such a visit could produce a warning or fine or a requirement for remedial action. Current enforcement efforts in New York City have already driven mercury sales underground in northern New Jersey. They have not stopped the sale or use of mercury.

Although we support labeling of mercury (in Spanish, English, and Haitian Creole, at appropriate literacy levels), we caution against a heavy-handed approach at this time, when there is no evidence directly linking cultural and religious mercury use with adverse health effects. Inspectors' visits are often perceived by the botanicas as adversarial, and these will likely have a negative effect on relationships with the community, lower the credibility of public health authorities and other government officials in the community, and lessen their effectiveness on other important community health issues. If the common practices of mercury use are those that cause minimal exposure, government intervention could unnecessarily bring additional strain on the tenuous relationship authorities have with many immigrant groups. Because mercury is not generally controlled in the United States, government intervention in these activities could very well constitute a violation of First Amendment rights to free exercise of religion, public health risks notwithstanding (42).

At the same time, immediate steps must be taken in the research community to characterize the extent of exposure that results from these uses. Reducing the uncertainty related to this issue in a timely manner is of utmost importance, so that regulators, backed by good data, can take appropriate action. This much-needed evidence includes clinical data on mercury levels in children, better evidence on frequency, amounts, and prevalence of use, and a better understanding of the relationship between these data and resultant air levels.

If high-level exposures are found to be widespread, long-term contamination of residences in urban areas with high immigrant populations could be an explosive environmental justice issue. Those responsible for contamination may not be able to afford remediation costs. A requirement to test buildings upon sale for mercury (and a duty to inform buyers and tenants)—similar to laws for lead or radon in some states—might be a reasonable locally implemented policy for identifying contaminated homes. The recent discovery of mercury contamination in the basements of Chicago homes caused by gas-pressure regulator replacement adds political weight to this proposal. Routine testing of children for mercury levels, as they

are tested for lead in some states, is another sensible and practical response.

Risk communication. Our interviews, though quite preliminary, indicate a lack of knowledge about the inhalation pathway as the primary route of mercury exposure. People seem to know that mercury is toxic and avoid touching or eating it in most cases, but they do not seem to know about volatilization and inhalation exposure.

Several education efforts have been undertaken in the past at local and national levels. In 1993 the Connecticut Department of Health Services initiated an education campaign in Hartford, assisted by the ATSDR and the Hispanic Health Council (43). This campaign was directed specifically to cultural and religious uses. U.S. EPA and the New York City Department of Health later developed their own resources based on this material (44). The U.S. EPA has also undertaken generalized mercury education in response to incidents involving school children (45).

A redoubled effort for risk communication, directed at all U.S. residents who may encounter mercury (most commonly perhaps through broken thermometers), should emphasize the knowledge gap regarding vapor inhalation to increase general awareness of mercury's exposure routes. Specific communications for communities that engage in religious and cultural uses can also be designed and distributed, in cooperation with neighborhood religious leaders. Because of the closed nature of the community and the secrecy of practice, these communications should also have a broad and general focus, applicable to many different types of exposure.

Labeling should be an integral part of a risk communication campaign for consumer mercury use. However, label warnings must pass multiple hurdles in order to be noticed, read, understood, and ultimately heeded (46–49). Because many factors will affect a person's decision to use or not use mercury, slapping a label on a mercury-filled gelcap is not likely by itself to reduce exposure significantly. But a good label can be effective when reinforced with other outreach efforts in a coordinated public health campaign.

Community involvement, outreach, and education. Because botanicas represent a critical link to health care services in Latino/a and Afro-Caribbean communities, it is important to recognize the role of botanicas in providing culturally congruent health interventions in their communities (2,50,51). Botanicas are the first place many turn for general health care services in Latino/a and Caribbean communities; any public health interventions to reduce mercury exposure must work with spiritualists, Santeros, and botanica proprietors. Working

cooperatively with botanicas to promote effective substitutes and institute labeling for mercury is more likely to be effective than an adversarial enforcement approach that essentially criminalizes cultural practices. Outreach in Afro-Caribbean and Latino/a communities is recommended. Such outreach and education will be most effective if they are coordinated with an effort to characterize the ways mercury use and its hazards are understood in the communities, so that communications can address any gaps in knowledge and provide the most salient information to mercury users.

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WHIP-AT-LARGE

Congress of the United States
House of Representatives
Washington, DC 20515

January 14, 1998

Benjamin Mojica, M.D., M.P.H.
Acting Commissioner
New York City Department of Health
125 Worth Street
New York, NY 10013

Dear Dr. Mojica,

This letter is in regards to your October 6, 1997 response to my initial inquiry on the subject of mercury poisoning problems in New York City.

In that letter, Ms. Enid L. Carruth, the Deputy Commissioner of Environmental Health Services, states that the "DOH visited six botanicas in Manhattan and Brooklyn and measured mercury levels in the air ... In five of the six botanicas no mercury was detected. In the sixth shop only trace amounts of mercury were detected."

To my dismay, I found that nearly identical language was used to allay an inquiry made to Mayor David Dinkins by Dr. Arnold Wendroff in 1993. I would be greatly disappointed if the Department of Health was using age-old data to respond to my recent inquiry. The health of New York's residents, especially those of our children, deserve constant vigilance, not laissez-faire attitudes.

I would also like to draw the Department's attention to a December 14th article in the New York Times. It is mentioned within the article that "A 1995 survey of 41 botanicas found that nearly 93 percent of them sold about one to four capsules of mercury daily." This published data obviously contradicts the DOH's efforts to find botanicas that sell mercury. It appears that the DOH was looking in the wrong places; if they were looking anywhere at all.

In my original letter, I offered a couple of suggestions, such as ensuring the proper labeling of mercury by either creating strict procedures or strongly enforcing current labeling standards and alerting "at-risk" consumers to the dangers of mercury poisoning. In light of your insufficient response, I again offer up these suggestions.

I look forward to reading your response.

Sincerely,

Charles E. Schumer
Member of Congress

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WHIP-AT-LARGE

NEW YORK STATE
CONGRESSIONAL DELEGATION
TREASURER

June 22, 1994

Dr. Arnold Wendroff
544 8th St.
Brooklyn, N.Y. 11215

Dear Dr. Wendroff:

Thank you for contacting me concerning warning labels on products with mercury metal. I appreciate you sending me the information outlining the dangers of this substance.

Your concerns about mercury metal used in household products are certainly valid and I agree with you that warning labels are a simple solution. As you outline in your letter, mercury metal is a highly toxic material that is especially dangerous for pregnant women and young children. It simply does not make sense that we regulate labelling of a multitude of dangerous household products and we do not have any regulation of this potentially hazardous material.

I want you to know that I have passed along your suggestion to the Food and Drug Administration and the Consumer Product Safety Commission. I depend on professionals like you, with "real world" experience, for some of the best ideas for legislation on health and safety of consumers.

Again, thank you for taking the time to write me about this issue. If I can be of further assistance, please let me know.

Sincerely,



Charles E. Schumer
Member of Congress

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WHIP-AT-LARGE

September 23, 1997

Benjamin Mojica, M.D., M.P.H.
Acting Commissioner
New York City Department of Health
125 Worth Street
New York, NY 10013

Dear Dr. Mojica,

I am writing to you today due to my concern over the suspected increase in the use of unlabeled mercury.

Through the diligent work of one of my constituents, Dr. Arnold P. Wendroff, many elected officials, including myself, have been made aware of the possibility of increased usage of unlabeled mercury by unaware New Yorkers. These anonymous vials are being sold for medicinal and religious purposes. The seriousness of this matter cannot be underscored enough.

As you know, exposure to mercury is an extreme health hazard. Studies have shown links between levels of mercury and birth defects, both neurological and physical, in children.

If Dr. Wendroff is correct, then many New York children are needlessly being put at risk. Therefore, I am suggesting that you do three things: ensure the proper labeling of mercury by either creating strict procedures or strongly enforcing current labeling standards, alert "at-risk" consumers to the dangers of mercury poisoning, and lastly, start a program which would test mercury exposure in children.

Thank you for your time. I look forward to hearing your responses to these suggestions.

Sincerely,

Charles E. Schumer
Member of Congress

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SUITE 1006
BROOKLYN, NY 11241
(718) 222-5819

August 8, 2000

Dr. Arnold P. Wendroff, Ph.D.
Mercury Poisoning Project
544 Eighth Street
Brooklyn, NY 11215-4201

Dear Dr. Wendroff:

I have received a copy of the July 25, 1999 that you sent to Vice President Gore. I am aware of the advocacy that you have been doing on behalf of victims of mercury poisoning in New York City for many years. I appreciate the work that you have done to bring this issue to light.

I agree with you that the high levels of exposure to mercury in households in the Bronx create a huge danger for the communities this effects. Community education and awareness needs to be a priority in order to ensure that families know the warning signs of exposure and prevention techniques.

Also, another look must be made toward the marketing and sale of mercury. This is a dangerous and unregulated substance that can cause serious harm upon prolonged exposure. I have included some suggestions for some regulators that you might consider reaching out to in your battle to protect the children of the Bronx.

There are three Federal entities that control the availability of the elemental mercury consumer product: the Food and Drug Administration, the consumer Product Safety Commission, and the Environmental Protection Agency.

Food and Drug Administration

The FDA is responsible for ensuring that drugs for use by humans are safe and effective, that foods are safe, wholesome, and sanitary, and that regulated products are accurately, informatively, and honestly prepared. You may wish to contact the legislative liaison at the FDA at (301) 443-3793) to discuss controlling mercury as a drug, food, or food supplement.

Consumer Product Safety Commission

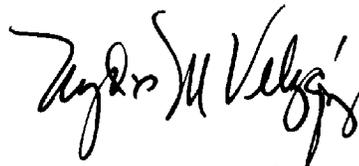
The mission of the CPSC is to protect the public against unreasonable risks of injuries and deaths associated with consumer products. If the mercury product is not considered to be marketed as a drug, food, or food supplement, control of the product may be possible under the jurisdiction of the CPSC. You may wish to contact the legislative liaison at the CPSC (301) 504-0515 to discuss controlling the mercury as a consumer product.

Environmental Protection Agency

The mission of the EPA is to protect public health and improve the natural environment. You may wish to contact the legislative liaison at the EPA (202) 260-7808 to discuss controlling the mercury product as a chemical in the environment.

Thank you again for reaching out to your legislators and representatives to spread the word about the importance of this issue. Please feel free to contact me about your concerns on this and any other issue.

Sincerely,



NYDIA M. VELÁZQUEZ
Member of Congress

NYDIA M. VELÁZQUEZ
12TH DISTRICT, NEW YORK

COMMITTEE ON BANKING AND
FINANCIAL SERVICES

SUBCOMMITTEE ON HOUSING AND
COMMUNITY OPPORTUNITY

SUBCOMMITTEE ON GENERAL OVERSIGHT
AND INVESTIGATION

COMMITTEE ON SMALL BUSINESS

SUBCOMMITTEE ON REGULATION AND
PAPERWORK REDUCTION



Congress of the United States
House of Representatives
Washington, DC 20515-3212

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WASHINGTON, DC 20515
(202) 225-2361

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2ND FLOOR
QUEENS, NY 11368
(718) 699-2602

May 5, 1997

The Honorable Henry Waxman
2204 Rayburn House Office Building
Washington, D.C. 20515

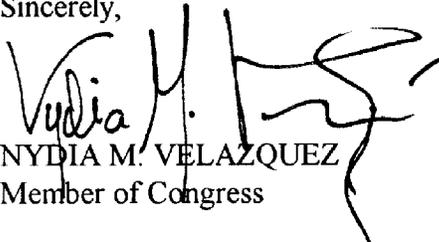
Dear Representative Waxman:

I would like to bring to your attention a concern raised by a New York constituent. Dr. Arnold Wendroff, of the Mercury Poisoning Project, has sent me a packet of materials detailing a very hazardous threat to the health of many of my constituents: the long-term exposure to mercury in Latin American and Caribbean communities as a result of its domestic use for magico-religious and ethno-medical purposes.

Mercury metal is sold in unlabeled containers for such purposes by shops called *botanicas*, which recommend it be used in ways likely to contaminate dwellings with mercury, exposing all household members to toxic mercury levels. According to Dr. Wendroff, The EPA has the authority to regulate the sale and use of mercury for domestic use under the Toxic Substances Control Act, but to date has not used its authority to mitigate this disturbing hazard. Furthermore, Dr. Wendroff informs me that 90% of mercury sold for these purposes bears no label, and thus violates the Consumer Product Safety Commission's regulations mandating that all toxic substances bear identification and warning labels.

I would appreciate it if you or one of your staffers could take a look at this material and perhaps offer suggestions as to how to proceed with this matter.

Sincerely,


NYDIA M. VELAZQUEZ
Member of Congress

cc: The Honorable Charles Schumer
Dr. Arnold Wendroff

NYDIA M. VELÁZQUEZ
12TH DISTRICT, NEW YORK

COMMITTEE ON BANKING AND
FINANCIAL SERVICES

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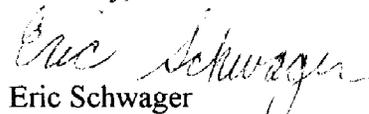
May 5, 1997

Dr. Arnold P. Wendroff
Mercury Poisoning Project
544 Eighth Street
Brooklyn, NY 11215

Dear Dr. Wendroff:

I appreciated hearing from you again last week. I am sending you a copy of the letter I prepared for Rep. Waxman, the Ranking Member of the House Government Reform and Oversight Committee and a leading environmentalist in the House of Representatives. I sent this letter, along with a copy of the packet you sent me, to Greg Dotson on Waxman's staff, and I will let you know when I hear something back from him. Should you have any questions in the meantime, please don't hesitate to call me.

Sincerely,


Eric Schwager
Legislative Assistant

Intoxication from mercury spilled on carpets

SIR,—Mercury intoxication (acrodynia, pink disease) from medicinal products is now so rare that many paediatricians and general practitioners may be unfamiliar with its often insidious onset and vague early signs. Environmental mercury pollution remains a cause for concern, and outbreaks of mercury poisoning associated with contaminated foodstuffs and water have been reported in several countries. I describe here chronic mercury intoxication in three children caused by a broken thermometer.

A 33-month-old girl was admitted in May, 1988, for anorexia, weight loss, light sensitivity, and eczema, starting 4 months previously. She had widespread severely itching eczema and pink, sweating, and scaling palms. She was ill-tempered and preferred to lie in bed or be taken around in a small buggy. She was sensitive to light. Acrodynia was suspected, and raised mercury concentration was found in the urine. After 2 weeks of chelation therapy with DMPS (2,3-dimercaptopropan-1-sulphonate; 'Dimaval' 30 mg twice daily) the child's eczema and mood began to improve. After 4 months of therapy all symptoms had disappeared and mercury excretion was normal.

This girl's 20-month-old sister had papulovesicular eczema with superinfections and severe prurigo which had started 6 weeks earlier; she had lately become anorexic. Her basal urine Hg excretion was low, but it increased after administration of DMPS. Symptoms started to disappear 2 weeks after the start of therapy, and she was clinically normal 4 months later.

The brother, aged 6 years 10 months, was the least severely affected of the three sibs. He had an itching exanthema and was thought to have been more nervous than usual. He had raised concentrations of mercury in urine after DMPS administration and improved with chelation therapy.

Urinary mercury concentrations ($\mu\text{g/l}$) were:

Date (1988)	Case 1	Case 2	Case 3
May 19	26.8		
25	55.1	6.9	
30	250.5*		
June 4	50.2		
7	230.8		
11		266.3*	
13	77.9		
14	10.9	146.7	
22	5.3	56.1	
29	19.8	82.6	
July 2			137.4*
6	41.7	6.8	37.8
13	55.8	4.7	46.2
20	4.0	23.2	14.0
27	25.4	20.0	
Aug 1			3.5
Oct 11	3.2	3.4	1.5

*Two days after DMPS. 3×50 mg per day.

Subsequently we learned that in the preceding autumn (ie, about 8 months earlier) a thermometer had been broken in the children's room which was small and had floor heating. The mercury had been spilled onto the carpet and was not retrievable. In the room air 9 months after the accident no mercury was detectable.

The cases described here show that even small amounts of mercury, spilled in a small, possibly not sufficiently aerated room, can cause severe acrodynia, presumably via metal vapour. These children were sent to the Kinderhospital with a diagnosis of neurodermitis and it took several days for the correct diagnosis to be

made. Nonetheless the clinical picture in the first child was classic and should have been sufficient for an instant presumptive diagnosis.

For occupational exposure monitoring, urinary excretion of up to 200 $\mu\text{g/l}$ and blood concentrations of 50 $\mu\text{g/l}$ are acceptable in Germany but young children are unusually sensitive. In 39 cases of acrodynia in children aged up to 5 years reported by Warkany and Hubbard¹ peak urinary concentrations of mercury were below 200 $\mu\text{g/l}$ in 24, and recent published German cases support this observation.²⁻⁶ Case 2 shows that the basal urinary excretion of mercury can be normal even in overt acrodynia, and the data presented here may be an important contribution to the debate on the safety of mercury amalgam dental fillings. Cases of chronic mercury poisoning may be being missed, even today, and all paediatricians and child psychiatrists should familiarise themselves with the clinical picture.

Kinderhospital Osnabrück,
D 4500 Osnabrück, Germany

KARL ERNST V MÜHLEND AHL

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"Elemental Mercury Poisoning Presenting as Hypertension in a Young Child"

by: E. Brannan, S. Su, & B. Alverson. *Pediatric Emergency Care*, August, 2012

"The uncontrolled use of ceremonial mercury is widespread, not currently being evaluated effectively, and is certainly not well appreciated,"¹ The illustrative case, "Elemental Mercury Poisoning Presenting as Hypertension in a Young Child,"² demonstrates these points, insofar as it overlooked information that clinicians serving and Latino communities need to be aware of. The paper suggests that the source of the mercury contaminating the Puerto Rican patient's home was from ritualistic mercury use by the prior Dominican³ occupant, but makes no mention that this is the first report reasonably associating magico-religious mercury use with mercury poisoning. In other words, this appears to be an index case of elemental mercury poisoning from inhalation exposure to mercury vapor resulting from the ritualistic use of elemental mercury in the home. It illustrates the most common scenario, second-hand exposure to mercury vapor from elemental mercury sprinkled or accidentally dropped on a floor during a ritual performed by a prior occupant, in this case, at least in part at the site of an altar on a bedroom dresser.^{3,4}

When the Dominican woman's subsequent apartment was tested, after her occupancy of some 3 months, markedly elevated mercury vapor levels were found, with the highest level, $5\mu\text{g}/\text{m}^3$, in the same locale as in her prior apartment, namely on the floor by her bedroom dresser, the site of her altar as reported by neighbors, where the mercury vapor level was $34\mu\text{g}/\text{m}^3$.³ The generally recommended evacuation level for mercury vapor in a home is $10\mu\text{g}/\text{m}^3$, with a reoccupancy level of $1\mu\text{g}/\text{m}^3$.⁵ Unfortunately, neither the Dominican woman or her teen age daughter were tested for elevated urine mercury levels (UMLs), until well after the initial case of acrodynia was reported.

The mercury vapor levels in the Puerto Rican family's carpeted apartment would likely have been much higher, had their landlord not employed a contractor to clean the apartment after the Dominican occupants departure. The commercial cleaner employed a powerful truck-mounted vacuum cleaner which would have exhausted most of the mercury in the carpeting to the outside air.⁶ However, enough mercury remained in the carpeting to grossly contaminate the Puerto Rican family's brand new vacuum to a level of $90\mu\text{g}/\text{m}^3$.⁷

In cases of mercury poisoning by vapor inhalation, it is essential that all occupants of the contaminated dwelling are promptly tested for the presence of elevated UMLs, as all are exposed to mercury vapor. When this testing was somewhat belatedly performed, the patient's 8 year old sister, 10 year old brother and 32 year old mother were all found to have highly elevated UMLs, of 73, 38 and $49\mu\text{g}/\text{L}$ respectively. The notifiable UML is $20\mu\text{g}/\text{L}$. The two siblings were chelated with DMSA.^{8,9} The father, who lacked health insurance, was not tested.⁷

It is noteworthy that all family members other than the 3 year old girl were asymptomatic, despite their exposure to high levels of mercury vapor and high UMLs, as were the prior occupants, a mother and her teen-aged daughter, who were presumably exposed to far higher levels of mercury vapor, and of a longer duration. The latter two women were never tested, despite their long residence in two mercury-contaminated dwellings, which would appear to be a lapse on the part of the RIDOH.

There could have been no clinical suspicion that any of them were at risk of intoxication, had not the 3 year old exhibited signs of acrodynia. Their exposure to toxic levels of mercury vapor would have continued were it not for their clinicians astute diagnosis of nowadays rare acrodynia. A somewhat

similar case of mercury poisoning of three siblings, with a 33 month old girl presenting with acrodynia, resulting from exposure to mercury from a broken clinical thermometer, led her physician to suggest that "Cases of chronic mercury poisoning may be missed, even today, and all paediatricians and child psychiatrists should familiarize themselves with the clinical picture."¹⁰

The dermatological aspects of the case described by Brannan et. al. were described in an earlier paper, whose authors also speculated that the source of the mercury was its ritualistic use.¹¹ They stated that "Prompt diagnosis and treatment of this disorder may help prevent long-term neurological sequelae." **Such prevention can only be achieved by promptly testing all members of a mercury-contaminated home, especially pregnant women and children.**

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3. John Leo, Emergency Response, Rhode Island Department of Environmental Management. Personal communication. 3/11/11
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6. D. Chevrette, Landlord, 117 Dexter Street, Cumberland, RI. Personal communication 3/3/11
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8. D. M____. Mother of 3 children, Personal communication. 11/27/12
9. S. Malcolm. Primary care physician to Puerto Rican family. Personal communication. 11/27/12
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[NOTE: These comments and corrections have not been published.]

international call for action to end half of the world's hunger before the year 2000.

The *Bellagio Declaration* stems from a unique meeting of 23 planners, practitioners, opinion leaders, and scientists from 14 countries at the Rockefeller Foundation Study and Conference Center in Bellagio, Italy, in November, 1989. It identifies four *achievable* goals for overcoming hunger in the 1990s: 1) to eliminate deaths from famine; 2) to end hunger in half of the poorest households; 3) to cut malnutrition in half for mothers and small children; and, 4) to eradicate iodine and vitamin A deficiencies. To date more than 250 technical experts, advocates, practitioners, and opinion leaders from 33 countries have endorsed the Declaration, and efforts are under way to promote the adoption of the declaration goals by the U.N. system, national governments, and other governmental and nongovernmental organizations.

The 1991 Briefing will be a key step toward developing a consensus on *implementation* of the Bellagio goals—how to link “top down” and “bottom up” approaches to the Declaration; how to find financial and institutional support for the promising work well. For more information, contact [redacted] will [redacted].

BASAPP Gavel and Pen Go to Collins, Shore

The British Association for Social Anthropology in Policy and Practice announces the retirement of Sue Wright as convenor and Peter Floyd as editor of *BASAPP News*. Jean Collins is now convenor and Crispin [redacted] is the new editor. Communications should be addressed to: Jean Collins, 10 [redacted] Kingswood, Surrey, KT [redacted] in Shore, [redacted] s

Society for Applied Anthropology Newsletter

February 1991

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Vol. 2, No. 1

[redacted] World
[redacted] Providence, Providence
[redacted] Telex 952095;
[redacted] @brownvm.bitnet.

Java Man Celebrates 100+ Birthday

Hans Beijer, Secretary General of the Pithecanthropus Centennial, announces an International Scientific Congress and Exhibition in The Netherlands and Indonesia on the Environmental Context of Human Evolution, commemorating a century of scientific recognition of Eugene DuBois' discovery of the Java Man, to be held during July, 1993. For further information contact: Hans Beijer, Geological Survey of the Netherlands, P.O. Box 157, NL-2000 AD Haarlem, The Netherlands; Telefax: +31-23-351614.

Environmental
identifying anthropolo-
subjects: community
participation and coordination of
radioactive site clean-up. The group
interested to know if there are any anthro-
working as staff members of the Environmental
Protection Agency and who have community relations or
social impact assessment roles. If there are sufficient
people and interest, communication between such
individuals is encouraged, as is a session on this subject at
the 1991 AAA meeting in Chicago. Is there anyone with
information or interest in participating in a session about
this? Please contact Dick Lemer, Environmental Branch,
U.S. Army Corps of Engineers, 211 Main Street, San
Francisco, CA 94105 (415/744-3340); FAX (415/744-
3312).

Bringing Attention to Mercury Threat

by Arnold P. Wendroff, Brooklyn, N.Y.

Mercury is used in countries throughout the Americas for various occult practices. Since the public is largely unaware of mercury's toxic nature, some of these occult practices result in the unintentional contamination of homes with mercury vapor (Wendroff 1990). Although

mercury has been put to such occult use for many years, a search of the literature failed to locate any reference to pathology resulting from such use. I suggest that this dearth of reported pathology is not an indication of the innocuous nature of these magical practices. Rather it is a reflection of the medial profession's unawareness of this newly reported practice, and the consequent failure to appreciate the subtle signs of chronic mercury intoxication in domestic, as opposed to industrial settings, where such toxicity has been long documented (Hardy and Finkel 1983:95).

These occult practices are related to, but not necessarily an integral part of, syncretic religions such as Santeria and Voodoo. In fact, it appears that the use of mercury lies more in the realm of folk magic than religion. Mercury is sold in shops called botanicas which stock herbal medicines as well as religious and occult articles (Murphy 1988). In the United States, Spanish speakers typically use the word *azogue*, rather than the more familiar *mercurio*, to describe elemental Hg used for occult purposes.

A telephone survey of 115 botanicas located in 13 cities across the continental United States and Puerto Rico, conducted by my assistant, D. Hernandez, found 99 of them selling mercury. A similar survey found mercury being sold by botanicas in Columbia, The Dominican Republic and Mexico. I have been informed that mercury is widely sold and used for occult practices in Haiti and Peru, and in most other Latin American and Caribbean nations.

Of 29 botanicas visited in New York City, the proprietors of 14 recommended that mercury be used in a manner likely to contaminate the user's home. The most common modality mentioned is to sprinkle mercury on the floor, followed by mixing it with soap and water used to mop the floor, or putting it into an open bowl and perhaps floating a magnet in it. All of these uses are for the purpose of driving away unwanted influences, such as malign spirits and sorcerers, and/or for attracting benign influences.

Botanica personnel suggested numerous other ways of using mercury, including mixing it with perfume or cologne, placing it in bathwater, mixing it with ammonia or camphor, or using it as a charm by carrying it about or hanging it on the wall to attract good and/or repel evil.

Another method mentioned by several botanicas is to place mercury in a glass enclosed candle. It appeared as if this would result in the rapid vaporization of the mercury due to the heat of the flame. However, a simple experiment indicated that little mercury actually escapes into the atmosphere. In practice, the wax melts to a depth of one or two centimeters, and the mercury sinks to the solid-liquid interface. Thus it is not only removed from the flame, but covered with a layer of molten wax which is relatively impermeable to mercury vapor. However, more accurate measurements of mercury vapor release are needed before pronouncing on the safety of this potentially hazardous practice.

We did not question our informants in any detail, so it is likely that mercury is used in other ways, and for other purposes. One such use was described to me by an expert on Santeria, who stated that *azogue* is widely used as a kind of catalyst to enhance the powers of love potions designed to attract or repel members of the opposite sex. However according to her experience, such charms are invariably prepared in closed containers such as a coconut shell, and therefore less likely to emit mercury vapor than direct atmospheric exposure.

Botanicas typically dispense mercury in gelatin capsules, or occasionally in glass vials. The usual price is \$1.00 and both the modal and medial weights of 41 samples purchased in New York City are approximately 8 grams, ranging from 1.5 grams to 31.3 grams. One informant states that significantly greater amounts are dispensed in Peru, with perhaps as much as 20 ml (270 g) sprinkled on the floor at once. It is evident that the amount of mercury dispensed varies greatly.

A botanica shopkeeper, apologizing for being out of stock, suggested that we purchase a fever thermometer and break it open for its mercury content. An examination of four thermometers (two oral and two rectal) of three brands found their mercury content to range from .60 to .72 grams, or well under one-tenth the typical dose of mercury dispensed by a botanica.

One proposed limit for chronic exposure to mercury vapor is one microgram per cubic meter (Mills 1990). The amounts of mercury usually dispensed by botanicas are more than sufficient to exceed that limit when sprinkled on the floor of a typical room. Mercury vapor levels will be even higher when mercury is applied repeatedly, a practice recommended by several botanicas. The suggested intervals between applications ranged from three to seven days, to be continued until the desired results were obtained. Such practice would result in very high atmospheric levels of mercury vapor.

Interior mercury vapor concentrations are affected by a variety of factors, including type of house construction, height above floor level, type of floor surface, ambient temperature and ventilation characteristics, as well as the amount, frequency and method of application (Hardy and Finkel 1983:101; Curtis et al. 1987; Knight 1988).

Botanicas themselves are likely to be heavily contaminated, posing an occupational health hazard to employees (Wendroff 1990). On several occasions we observed spillage of mercury by shopkeepers as they filled vials or capsules for sale, but failed to carefully clean up the mercury on the floor. One proprietress stated that she intentionally scattered mercury about her botanica in order to "bring good things," and also added a bit to each prescription she dispensed.

Another way in which the public is unknowingly exposed to mercury is by means of second-hand exposure such as occurs when a tenant scatters mercury on the floor, and later vacates her apartment. The residual mercury trapped in cracks in the floor continues to evaporate, and the dwelling's new occupants are unknow-

ingly exposed to mercury vapor (*Morbidity and Mortality Weekly Report* 1990). Clinicians engaged in case-finding are thus unable to ascertain by means of questioning whether such unknowingly exposed individuals are at risk. Alternative methods of case-finding, such as surveys making in-situ mercury vapor measurements, or random testing of urine samples are likely to be prohibitively expensive for most ministries of health. Furthermore, there is a poor correlation between urine mercury levels and pathology. This presents serious problems for public health authorities engaged in casefinding and treatment.

Individuals at greatest risk of mercury intoxication are small children and the fetus in utero. Both suffer proportionately greater damage from mercury vapor exposure than adults (Koos and Longo 1976; Sikorski et al. 1987), with sequelae more likely to be permanent (Curtis et al. 1987). Mercury vapor passes both the placental and blood-brain barriers (Battigelli 1983), and is excreted in breast milk (Knight 1988). Additionally, the vapor is heavy, so that infants and children sleeping, crawling or playing on the floor are exposed to the highest concentrations of vapor (Battigelli 1983:454).

It is evident that a concerted effort is necessary to assess the extent of this newly recognized health problem. Sociological research is required to ascertain the beliefs associated with mercury use, as well as the extent of such use. The development of an effective health education campaign is contingent on such social science research. Epidemiological investigations are needed to assess the levels of mercury vapor in dwellings and mercury burdens of individuals, and their pathological effects. The implementation of such programs, perhaps coupled with restrictive legislation on the sale of mercury to the lay public, should be considered by health authorities throughout the hemisphere.

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PA Will Target Tourism in '92

Practicing Anthropology plans an early 1992 issue devoted to Tourism for which articles are being solicited. Topics suitable for the issue might describe projects involving mitigation of physical and cultural impacts induced by tourism; the use of tourism in economic development; training in tourism, in schools as well as for professionals; etc. The focus is on applied anthropology and research "beyond the University." Length should be appropriate to the topic.

Coordinating editor for this issue is Valene Smith, Department of Anthropology, California State University, Chico, Chico CA 95929-0400: (916/898-6192); FAX 916/898-6824; E-mail: EEFA06N@calstate.bitnet.

Abstracts with estimated length of finished paper should be forwarded immediately. Completed papers must be received by September 1, 1991.

Sanctuary and Agencies Combine Forces to Prosecute Looters

A Department of Commerce Administrative Law Judge has fined seven Los Angeles-area scuba divers a total of \$132,000 for removing artifacts from two historic shipwrecks in the Channel Islands National Park and the

"Acrodynia and Hypertension in a Young Girl Secondary to Elemental Mercury Toxicity Acquired in the Home,"

by J. Mercer, L. Bercovitch and J. Muglia *Pediatric Dermatology*, March, 2012

The report of "Acrodynia and Hypertension in a Young Girl Secondary to Elemental Mercury Toxicity Acquired in the Home,"¹ makes a useful contribution to the dermatological literature, but omits some important clinical implications.

Additionally, although correctly attributing the source of the mercury exposure to vapor emanating from mercury spilled on carpeting by a prior occupant, the report misstates those vapor levels as being as high as 40,000 $\mu\text{g}/\text{m}^3$, when in fact they ranged from 10 - 34 $\mu\text{g}/\text{m}^3$.² Also, the mention of the "normal" mercury vapor level as $<100 \mu\text{g}/\text{m}^3$ is erroneous, as the residential evacuation level for mercury vapor is 10 $\mu\text{g}/\text{m}^3$, and the residential reoccupation level a mere 1 $\mu\text{g}/\text{m}^3$.³ The family was evacuated from their apartment when the elevated vapor levels were discovered.

The authors suggest that clinicians "must have a high index of suspicion to recognize mercury toxicity," but omit mentioning that this suspicion must be directed to *all* occupants of a mercury-contaminated dwelling. In this case, the 3-year-old patient's 8-year-old sister, 10-year-old brother, and 32-year-old mother, all had highly elevated urinary mercury levels (UML), of 73, 38 and 49 $\mu\text{g}/\text{L}$ respectively.⁴ The notifiable UML in many states (RI, NY, NJ) is 20 $\mu\text{g}/\text{L}$, but it can be as low as 3 $\mu\text{g}/\text{L}$ (NM).

Clinicians and public health authorities should note that despite their highly elevated UMLs, the other family members were asymptomatic. Had not the 3-year-old girl exhibited the rare signs of acrodynia, in all likelihood the entire ethnically Puerto Rican family would have remained in their mercury-contaminated dwelling, continuing to inhale developmentally neurotoxic levels of mercury vapor.

The report omits mentioning that their elevated UMLs led to the girl's two siblings being chelated at their primary care medical facility,^{4,5} The father's UML was not assessed, allegedly because he lacked health insurance.

This paper is especially significant, as it presents what is in essence an index case of mercury poisoning resulting from its ritualistic use.^{6,7} In this case, which appears to be a typical scenario, (save for the 3-year-old's acute illness), an entire family was intoxicated via second-hand inhalation exposure to mercury vapor emanating from an earlier mercury spill apparently resulting from likely magico-religious mercury use in a Caribbean/Latino cultural context.

The authors note that the mercury's "source could only be speculated," but mention that "some religions in Afro-Caribbean cultures ... ritually sprinkle elemental mercury about the home..." Circumstantial evidence strongly suggests that the prior Dominican occupant of the contaminated carpeted apartment was the source of the mercury.^{2,6} The official environmental assessment² noted that the prior occupant, a Dominican⁶ (not Columbian as mentioned in the report) woman practiced various rituals on an altar on her bedroom dresser. The only liquid mercury droplets were found in the carpeting by the former site of that dresser, as were the highest mercury vapor levels. When the Dominican woman's subsequent apartment was tested for the presence of mercury vapor, the highest levels ($>5 \mu\text{g}/\text{m}^3$) were again found in front of her dresser/altar.²

Although the state report mentions that "The potential exists for several more homes to be checked for mercury issues," there was no assessment of mercury vapor levels in the apartment occupied by the Dominican woman prior to her moving into the apartment that poisoned the Puerto Rican family. Despite the fact that the Dominican woman and her teen-aged daughter had occupied that grossly contaminated premises for over a year, and although their subsequent apartment was contaminated to half the evacuation level, neither of their UMLs were assessed.

Clinicians serving Caribbean and Latino communities where ritualistic mercury use is likely to be or have been practiced, should be aware of the likelihood of these second-hand ritualistic mercury vapor exposures, as mercury spills can persist for decades at toxic (especially developmentally neurotoxic) levels.^{3,9}

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[NOTE: These comments and corrections were not published!]

Magico-Religious Mercury Use and Cultural Sensitivity

In his recent commentary, "AIDS Prevention and Cultural Sensitivity: Are They Compatible?" Bayer concluded, "Homilies about cultural sensitivity must be replaced by a forthright acknowledgment that we cannot seek radical behavioral and normative change while adhering to a dictum that serves principally to protect the status quo."^{1(p897)}

Although Bayer specifically addresses acquired immunodeficiency syndrome (AIDS), his logic pertains to other complaints possessing culturally determined risk factors, including intoxication resulting from the magico-religious use of mercury in Hispanic and Caribbean homes.² Although the Environmental Protection Agency (EPA) has recently initiated a public awareness campaign to deal with "the burning or sprinkling of elemental mercury in homes and cars,"³ there has

been resistance on the part of numerous Hispanic "stakeholder" organizations to "regulatory action" involving the sale of illegally unlabeled mercury for magico-religious and ethnomedical use.⁴

Despite urging EPA "to begin its risk communication efforts quickly in order to show its concern for the affected population,"^{4(p7)} the three national Hispanic stakeholder organizations EPA consulted felt that a more active intervention, such as enforcing the existing Federal Hazardous Substances Act labeling requirements (16 CFR §§1500-1512), "would send the message of government interference in the practicing of one's religion."^{4(p8)} The stakeholder organizations agreed that "any discussion of the religious implications of [mercury use] should be omitted from the risk communication message."^{4(p7)}

EPA stated that "because of the cultural aspects of this problem [of magico-religious mercury use], any regulatory action would probably be very difficult to enforce."^{4(p6)} Similar sentiments have been voiced by the Consumer Product Safety Commission (CPSC), which has refused to exercise its subpoena powers to examine the sales records of distributors of illegally unlabeled or inadequately labeled mercury. Such records provide data on the amount of mercury sold for magico-religious purposes, as well as the geographical distribution of such sales, and would eliminate "many [of the] uncertainties . . . regarding the extent . . . of use of mercury in these practices."^{4(p3)} Both EPA's and CPSC's actions (or inactions) illustrate Bayer's observation that "acceding to the demands of cultural sensitivity . . . not only is not a prerequisite for effective public health practice but would be inimical to the goals of . . .

prevention." Both EPA and CPSC appear to have acceded to these demands by failing to enforce existing culturally neutral regulations requiring adequate labeling of mercury. They are thus maintaining the status quo at the expense of protecting the public's health. □

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Magico-Religious Mercury Use in Caribbean and Latino Communities: Pollution, Persistence, and Politics

Arnold P. Wendroff

Elemental mercury is put to magico-religious uses, most problematically the sprinkling of mercury on floors of homes in Caribbean and Latino communities. Indoor mercury spills are persistent and release toxic levels of mercury vapor over long periods of time. Surveys in these communities have demonstrated widespread and large-scale mercury sales for ritualistic use, elevated mercury vapor levels in public hallways, increased amounts of mercury in wastewater, and elevated urine mercury levels in Latino children. Yet no clear connection has been drawn between ritualistic mercury use and these elevated levels, nor has any pathology been associated with such use. Social, political, and economic factors have acted to preclude advocacy for these affected communities, whose members are largely unaware of their mercury exposure (frequently secondhand) and of its adverse health effects. Without the political mandate to act, environmental agencies have not allocated the resources necessary for environmental professionals to assess and respond to this latent environmental health disaster. Steps to investigate and respond to this impending public health emergency are suggested, as presently there is no coordinated plan for assessing and remediating the tens of thousands of dwellings around the country likely to be contaminated with actionable levels of mercury vapor.

Environmental Practice 7:87–96 (2005)

In 1989, a “learning disabled,” ethnically Puerto Rican ninth-grader in Brooklyn, New York, told his chemistry teacher that his mother sprinkled mercury on the floor of

their apartment to keep away witches. The teacher’s curiosity was aroused; he investigated, found mercury to be widely sold in the community for such uses (Wendroff, 1990), and concluded that his student exhibited symptoms of erethism arising from exposure to mercury vapor. The boy was anorexic, irritable, had short-term memory loss, and exhibited an aversion to being observed, periodically placing his head on his desk and covering it with his inverted loose-leaf notebook (Hartman, 1995). This chance observation was the starting point of much of the research described below.

Nature of the Problem

It has long been recognized that small mercury spills in homes, most commonly from broken thermometers, can produce elevated levels of mercury vapor for long periods of time (Carpi and Chen, 2001; US Environmental Protection Agency, Region 1, 2005). When such spills are reported to public health authorities, assessment and cleanup activities are regularly initiated and contaminated areas are evacuated. Such government concern about mercury toxicity is not in evidence, however, when it comes to other forms of domestic mercury contamination. In some Caribbean and Latino communities, folkloric practices and religious beliefs associated with Santeria, Espiritismo, and Voodoo attribute to mercury the power to attract good and repel evil. In these neighborhoods, elemental mercury is sold for magico-religious and ethnomedical uses by shops called *botánicas* (in the Southwest, *herboristerias* or *yerberias*) in unlabeled vials and fragile gelatin capsules containing an average weight of 10 grams of the metal. The only laws governing such sales appear to be federal and local labeling regulations, regulations that are generally flaunted, as over 90% of mercury sold by *botánicas* bears no labeling at all. Many, perhaps a majority, of ritualistic mercury users are ignorant of either the toxicity of mercury vapor, particularly to the developing brain (Goldman

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and Shannon, 2001), or of the persistent nature of mercury spills (US Environmental Protection Agency, 2002).

Even small, thermometer-sized mercury spills are extremely persistent and can generate problematic levels of mercury vapor for many years. A fever thermometer typically contains 0.7 grams of mercury. One study found residual mercury from a broken thermometer on a tiled bathroom floor continuing to emit substantial levels of mercury vapor after a period in excess of 15 years. The authors concluded that “mercury released from household devices can contaminate indoor residential environments for decades after the first release of this metal, . . . [and] this exposure route may raise significant concerns regarding mercury health effects in young children” (Carpí and Chen, 2001). The actual mercury vapor measured in a recent Agency for Toxic Substances and Disease Registry (ATSDR) investigation of a thermometer mercury spill found that this “small amount of elemental mercury can be readily volatilized by vacuuming and has the potential to pose a long-term human health exposure concern” (Nehls-Lowe and Morrison, 2004). Given the fact that mercury for magico-religious uses is typically sold in 10-gram units, it is reasonable to assume that spills resulting from such use are a great deal more problematic.

Several articles, reports, and conferences have addressed the putative adverse health effects of elemental mercury exposure across its spectrum of ethnomedical and magico-religious uses. The ethnomedical uses include ingestion of mercury to treat abdominal complaints, and intravenous and subcutaneous injection of mercury to boost energy and to protect against infections and evil influences (Celli and Khan, 1976; Geffner and Sandler, 1980; Hryhorczuk, 2004; Prasad, 2004; Trotter, 1985). The magico-religious uses include placing mercury in perfume and candles, mopping the floor with it, and mixing it into bathwater (Greenberg, 1999; Wendroff, 1990). The most environmentally problematic uses, and apparently some of the most common, involve placing mercury in a variety of open or unsealed containers and directly sprinkling mercury on floors and furnishings and inside motor vehicles (Riley et al., 2001). In 1990, the Surgeon General of the Public Health Service wrote: “The ritual of sprinkling mercury on the floor to ward off ‘evil spirits’ is practiced by selected minority groups and may pose potential hazards to those who encounter the mercury” (Novello, 1990). Fifteen years later, these rituals involving mercury are still generally considered a “potential” (versus an actual) health threat, largely because economic and political pressures have operated to retard substantive investigation of the problem.

Scale of Ritualistic Mercury Use

Although, to date, ritualistic mercury spills have not been reported to health authorities, have not been aggressively investigated by these authorities, and have not been described in first-hand case studies in the medical literature, the belief in their occurrence appears to be well founded given the conspicuous place mercury occupies in the beliefs and practices of Hispanic communities. A 1990 survey of 100 Caribbean and Latino women at a public hospital in Brooklyn, New York, found 25% familiar with esoteric uses of mercury (US Environmental Protection Agency, 2002, p. 3). A 1993 survey of ritualistic mercury use in Hartford, Connecticut, and its environs documented substantial botánica sales and use in this largely Puerto Rican community (Hispanic Health Council, 1993; US Environmental Protection Agency, 2002, p. 2). A survey of a largely Dominican community in Massachusetts found that 38% of respondents either used mercury themselves or knew someone who had used it, with 12% of respondents reporting that mercury was sprinkled around a child’s crib or bed (Latowsky, 2003). A similar survey in New York City found that “[f]orty-four percent of the respondents from the Caribbean and 27 percent from Latin America stated that elemental mercury is used in their homes, cars or carried on their person in these cultural practices” (Johnson, 1999). A survey in Chicago found 16 out of 79 Latinos (mainly women) who had used mercury on several occasions (Chicago Department of Public Health, 1997). Given these statistics, it is virtually certain that spills from the ritualistic use of mercury occur with significant frequency, that they result in contaminating dwellings with high levels of mercury vapor (Greenberg, 1999), and that such contamination results in mercury absorption by the occupants of those dwellings “orders of magnitude greater than (methyl) mercury exposures from eating fish or from the leaching of mercury from amalgam fillings” (Wendroff, 1997). The Natural Resources Defense Council has estimated that in the Bronx, New York, ritualistic mercury use “would be likely to cause long-term contamination of more than 13,000 homes or apartment buildings each year” (Quintero-Somaini et al., 2004).

Community Response

The likelihood of contamination of large numbers of Caribbean and Latino homes with substantial amounts of elemental mercury presents a challenge to environmental professionals and a potentially enormous problem for federal agencies (among them the US Agency for Toxic Substances and Disease Registry, the Centers for Disease Control

and Prevention, and the US Environmental Protection Agency) and for state and local health departments. Unlike exposure to methylmercury in fish or to elemental mercury in amalgam dental fillings, exposures to magico-religious mercury spills (1) cannot be limited by changes in diet or dentistry, (2) are likely to entail enormous costs to government for their remediation (Malecki et al., 1995), and (3) have the potential to engender panic among families with pregnant women and small children living in communities where large numbers of dwellings have been contaminated by ritualistic mercury spills (Edelstein, 1988). In contrast to the relative ease of checking dwellings for the presence of lead, radon, and asbestos, assessment of mercury vapor cannot be performed by do-it-yourself lay occupants. Detecting low levels of mercury vapor necessitates inspection by environmental professionals employing sophisticated instrumentation. Unseen mercury droplets lurk in porous flooring, and micro-droplets formed when spills are vacuumed adhere to all interior surfaces.

In typical “toxic disasters,” blame for widespread residential toxic exposures lies with corporate and government polluters. When such deep-pocketed polluters are identified, the wrath of the affected communities is focused on them and remediation and compensation are sought (Edelstein, 1988) and often gained. In one recent case, a corporation responsible for numerous residential mercury spills spent over 140 million dollars in cleanup costs and inspected over 200,000 homes for the presence of mercury (US Agency for Toxic Substances and Disease Registry, 2001; Williamson, 2000). This program resulted in a run on the market for portable mercury vapor analyzers, including 140 instruments leased from one manufacturer (Illinois Attorney General, 2000) and 100 purchased from another (Fenzel, 2005). A class-action lawsuit determined the defendant gas distribution company and its contractors to be liable for negligence, willful and wanton conduct, property damage, and medical expenses resulting from mercury spills from gas distribution equipment in homes (Circuit Court of Cook County, 2001).

By contrast, communities affected by ritualistic mercury contamination of dwellings cannot place the blame on corporate negligence and greed. “Any harm resulting from these practices is not only self-inflicted but also culturally sanctioned. Moreover, no readily apparent epidemic of mercury-related disease has generated the overtly ‘visible victims’ often necessary to bring about aggressive remedial action on the part of already overburdened public health officials. Attempts to call attention to the risks involved have regularly met [with]

indifference and sometimes even outright hostility” on the part of those charged with safeguarding the public health (Foreman, 1998).

Community-based environmental justice organizations have, for the most part, not yet engaged in the issue of ritualistic mercury contamination of dwellings. Despite their acknowledgment that “community members were the only experts who could gather information on such things as angler practices [contributing to methylmercury exposure] and the home remedies used by Latinos . . .” (Corburn, 2002) and their awareness of ritualistic mercury sales by botánicas in their neighborhoods, many have refrained from addressing this issue.

As a result of this indifference, in the 15 years since the health threat posed by ritualistic mercury use has been described in both the medical literature (Greenberg, 1999; Prasad, 2004; Riley et al., 2001; Wendroff, 1990, 1991) and the mass media (Castillo, 2004; Ojito, 1997; Rauch, 1991; Vinicio, 2001), there has been essentially no advocacy on this issue from Caribbean or Latino community organizations, medical professionals, or political representatives. Packard et al. (2004) recently made the statement that “illnesses ‘emerge’ from the suffering of individual patients to become medically recognized problems and public health issues.” As no one appears to be suffering from mercury poisoning, no one is advocating for government to substantively address the issue, aside from a few nominal and inconclusive pilot studies. The relatively straightforward research needed to demonstrate mercury contamination of dwellings and to correlate it with biomarkers of mercury absorption has not been conducted. Government knows what to do, but evidently feels that an actual demonstration of ritualistic mercury contamination, especially with attendant clinical involvement, would open a Pandora’s box that it would rather leave undisturbed.

The following example illustrates governmental ambivalence on this issue. The US Agency for Toxic Substances and Disease Registry (1999) has stated, “There is an urgent need to obtain information on the levels of exposure from these [ritualistic] practices to determine if children or adults are at risk. Mercury vapor concentrations may be much higher after use during the winter months when the heat is turned on and the windows are closed, so data that reflect a variety of exposure scenarios are also needed.” Yet despite this declared “urgent need,” the agency in question has of yet funded no research to meet it.

Real Estate Industry Response

Although the real estate industry has moved to protect tenants from residential toxic exposures, most notably from lead in paint, landlords tend to act only when litigation-driven regulations are enacted (Cahn and Thompson, 2003). Economic constraints make it difficult for landlords, and on occasion for government agencies as well, to apply the Precautionary Principle, which states that if reasonable evidence of toxic exposures exists, then efforts to reduce or eliminate such exposures should be implemented “even in the absence of clear, scientific evidence of harm” (Raffensperger and Tickner, 1999) and that “to wait for scientific certainty (or near certainty) is to court disaster” (Wyman and Stevenson, 2001). In strictly economic terms, then, it is understandable that the applicability of the Precautionary Principle to ritualistic mercury exposure has essentially been ignored by the real estate industry, by government, and by the environmental medical profession, though it is nonetheless deplorable. This is of course hardly the first instance in which, in the collision of economic interest with the Precautionary Principle, the Precautionary Principle has had to give way.

An instance of such a failure to act prior to “scientific certainty” began with an editorial preface to an article on ritualistic mercury contamination of homes, appearing in an environmental publication serving the real estate industry. The editors wrote, “Phase I Environmental Site Inspectors should be sure to notify their lender clients about the risk of mercury contamination in certain residential neighborhoods. Frequently, lenders are unaware of the variety of risks endangering the value of their residential real estate owned. The following is just one of the many ways lenders’ collateral can be jeopardized” (Wendroff and Jetter, 1999). Yet despite such editorial admonition and the wealth of circumstantial evidence of serious and widespread ritualistic mercury contamination presented in the article itself and in several subsequent studies (Garetano, 2004; Latowsky, 2003), to date there has been no apparent interest on the part of the real estate industry, or the environmental assessment profession serving it, in assessing and addressing the widespread contamination of homes with ritualistic mercury.

It seems likely that when the extent and impact of this environmental health threat are ultimately demonstrated, testing of housing stock for mercury vapor at the time of transfer will be mandated, as is currently the case with lead, radon, and asbestos. The political constraints retarding the implementation of such a program will no doubt

be very great. The New York City Housing Authority (NYCHA), possibly somewhat more of an advocate for tenant protection than the private housing sector, has failed to assess its own heavily Caribbean and Latino housing developments and has declined an offer from outside to provide free surveillance of mercury vapor levels in public housing hallways, this despite its own assurance that “NYCHA is giving serious consideration to the mercury issue” (Clarke, 2002). This same communication stated that the New York City Department of Health recommended that NYCHA await the results of an investigation by the New Jersey Department of Environmental Protection. When that study demonstrated that there were elevated mercury vapor levels in Latino housing (Stern et al., 2003), NYCHA still did not assess its own buildings for elevated levels of mercury vapor. The US Department of Housing and Urban Development (HUD) has displayed the same apparent indifference to addressing this issue. A HUD official wrote to acknowledge “a potential environmental health threat caused by contamination of homes, including HUD properties, through ritualistic uses of mercury,” and went on to state that HUD was awaiting results of studies from the Centers for Disease Control and the US Environmental Protection Agency (USEPA) before being able to “justify in-depth environmental assessments” (Teninga, 2002).

Government Agency Response

The Agency for Toxic Substances and Disease Registry’s chronic minimal risk level for domestic mercury vapor exposure is $0.2 \mu\text{g}/\text{m}^3$, and USEPA’s domestic mercury vapor evacuation was recently lowered to $1 \mu\text{g}/\text{m}^3$ by joint ATSDR, USEPA, and Washington, DC, Department of Health consultation over a mercury spill incident so as to be more protective in cases of fetal exposure (Blum and Fernandez, 2003; US Agency for Toxic Substances and Disease Registry, 2003). Government has no direct mandate to lower the body mercury burden of individuals with clinically elevated mercury levels resulting from fish consumption or amalgam dental fillings; however, when mercury contamination of a dwelling is suspected, government has often assumed responsibility for assessment and frequently for decontamination (Baker et al., 2005; Malecki et al., 1995). The same will likely be the case in ritualistic mercury spills, when it generally will be impossible to determine who is legally responsible for the spills and when occupants and frequently landlords will be unable to pay the cleanup costs. As experience with the assessment and cleanup of ritualistic mercury spills mounts, growing familiarity with the pattern and intensity of mercury distribution will make

the identification of ritualistic mercury contamination more assured.

Mounting evidence suggests that large numbers of homes in Caribbean and Latino communities are contaminated with actionable levels of mercury vapor. Much of this mercury contamination was likely caused by prior mercury-using occupants. This residential contamination is believed to result in significant second hand exposure (Greenberg, 1999; Johnson, 1999). Occupational exposures are likely to occur in shops that sell mercury. The New York City Department of Health inspected 20-odd botánicas, many of them known to have sold the metal. Several had elevated mercury vapor levels, and one had from 13 to 17 $\mu\text{g}/\text{m}^3$ in the store itself and from 4 to 7 $\mu\text{g}/\text{m}^3$ in stairwells and hallways leading to the three floors of apartments above (New York City Department of Health and Mental Hygiene, 2000). The New Jersey Department of Environmental Protection found substantially elevated indoor air mercury vapor levels in public vestibules and hallways of heavily Hispanic multifamily housing. It reported that although “most indoor samples were low . . . about 17% of buildings had average air levels above 20 ng/m^3 , with one building average at 299 and a maximum internal reading of 2000 ng/m^3 [2.0 $\mu\text{g}/\text{m}^3$, or twice the recommended evacuation level]” (Stern et al., 2003). A recent survey found that of four apartments actually entered, the mercury levels inside were on an average 5.5 times (ranging from 3.8 to 8.8 times) higher than those detected at the doorjamb in the hallway (Puchalik, 2005). One investigator stated, “The cultural use of mercury has been identified as a potential source of mercury vapor exposure in [these] New Jersey residential settings. In this instance, elemental mercury may be intentionally dispersed within a residence. . . . We conclude that indoor mercury vapor concentrations are substantially elevated over outdoor concentration in many instances. The concentrations in some buildings approach levels of public health concern” (Garetano, 2004).

In late 2001, the US Environmental Protection Agency began a simulation to measure mercury vapor levels from ritualistic spills in a home. Mercury was sprinkled on carpeting inside a house trailer and vapor levels were monitored. A final report has yet to be released, owing to the fact that external reviewers found flaws in the simulation design, which tested only a single type of flooring and simulated neither the effects of walking on it nor of vacuuming it. More problematic still was the incongruity of the experimental results with real-world experience of domestic mercury spills requiring lengthy decontamination to reduce

mercury vapor to a reoccupation level below 1 $\mu\text{g}/\text{m}^3$. The authors concluded, “Intentional ritual sprinkling of metallic mercury. . . may initially produce indoor air mercury vapor levels above the ATSDR suggested residential occupancy level, and in some cases, above the action level, but the concentration decreases over time and generally falls below the residential occupancy level” (Singhvi et al., 2004). The authors go on to state that “ATSDR has proposed a residential occupancy level of 1.0 microgram per cubic meter of air (1 $\mu\text{g}/\text{m}^3$) as the mercury level considered ‘safe and acceptable’ for occupancy of any structure after a spill, provided that no mercury is present” (US Agency for Toxic Substances and Disease Registry, 2001).

Contrast these simulation findings with the actual case of a thermometer containing approximately 0.7 grams of mercury that was broken on the dresser and hardwood floor of a bedroom occupied by a pregnant woman. The occupants cleaned up the visible droplets and then vacuumed the floor. Five days later, mercury vapor levels in the bedroom were over 14 $\mu\text{g}/\text{m}^3$, and the occupants were advised to evacuate the bedroom and ventilate it. Seven days after the initial spill, the bedroom had levels of 2 to 3 $\mu\text{g}/\text{m}^3$, or twice the current recommended evacuation level (Nehls-Lowe and Morrison, 2004). This scenario, involving a minute amount of mercury—probably well under 0.5 gram—should be compared with the situation in which the average 10-gram quantity of ritualistic mercury is spilled in the home, no attempt is made promptly to clean it up, it is tracked about to other rooms and to adjacent hallways and apartments, and in many cases the floors are routinely vacuumed.

Data on botánica mercury sales in the heavily Hispanic Bronx, New York, indicated a range of 25,000 to 155,000 9-gram mean-weight-units of mercury sold in one year (1995), with some 30% of those units likely to be sprinkled on floors (Zayas and Ozuah, 1996). The enormous sales and ritualistic use of elemental mercury in New York City and its environs, estimated at between 500 and 3,000 pounds per year in the Bronx alone (Baard, 2001; Zayas and Ozuah, 1996), has a significant but little appreciated environmental impact. Ritualistic mercury is placed in bathwater and in water for mopping floors, and unused mercury is dumped down drains (Johnson, 1999). Ingested and inhaled mercury is also excreted in feces and urine and, along with discarded mercury, may substantially add to the mercury burden of wastewater (New York City Department of Environmental Protection, 2004). These uses and excretory and disposal pathways allow mercury to enter the aquatic

environment. In the New York/New Jersey harbor, the median source of mercury influx has been found to be divided equally between emissions from electric power plants and emissions resulting from the religious and cultural uses of mercury, each estimated at from 200 to 600 kilograms per year (de Cerreno, Panero, and Boehme, 2002). Several analyses for metals influent to New York City's wastewater treatment plants have found excesses of mercury apparently associated with ritualistic mercury use. The New York City Department of Environmental Protection therefore sampled a small, overwhelmingly Dominican residential area and found major excesses of mercury, 10 to 100 times above the norm (albeit associated with copper, lead, and zinc). The source of this mercury seems likely to be from the contamination of drain traps when ritualistic mercury is disposed (New York City Department of Environmental Protection, 2004).

Biomarker Studies

A pilot study of pediatric urine mercury levels of Hispanic children in the Bronx found 5% with what were deemed to be clinically elevated levels of 5 to 11 $\mu\text{g}/\text{L}$ (Ozuah et al., 2003). A recent Centers for Disease Control/New York City Department of Health study of urine mercury levels of over 400 Caribbean and Latino children in New York City found one with a notifiable level of 24 $\mu\text{g}/\text{L}$ (Jeffery, 2004). The notifiable urine mercury level in New York State is 20 $\mu\text{g}/\text{L}$. Another mercury biomarker study is under way in New York City as part of a citywide health and nutrition examination survey. A study in Chicago found none of the 400 Latino children tested had elevated urine mercury levels (Rogers, Caldwell, and McCullough, 2004). Both blood and urine mercury levels are being measured in a representative sample of 2,000 adults in New York City, the urine mercury levels being measured because of concern over ritualistic mercury exposure (New York City Department of Health and Mental Hygiene, 2004). Unfortunately, these several urine mercury level investigations were designed without reference to recent findings that urine mercury levels resulting from exposure to low levels of mercury vapor, i.e., "below 10 $\mu\text{g}/\text{m}^3$ " are "likely to be indistinguishable from background urinary mercury levels" (Tsuji et al., 2003), so their conclusions are essentially invalid. Scientists from the Centers for Disease Control and Prevention and the New York City Department of Health and Mental Hygiene have stated that their results have been released in a public forum, although no manuscripts have been published as yet (Jeffery, 2005; Rubin, 2005).

Discussion

Fear of the prospect of having to evacuate and decontaminate many thousands of homes in Caribbean and Latino communities around the country has undoubtedly acted to retard substantive environmental and clinical assessment of the ritualistic mercury problem. At the August 2004 conference of the International Society for Environmental Epidemiology, the oral session on "Urban/Ritualistic Mercury Exposure: Assessment to Intervention" demonstrated government ambivalence toward addressing the problem by its failure to mention any substantive governmental "assessment" or "intervention." The tenor of the session illustrated the issues addressed by J. H. Perkins's editorial, "Mercury: Persistence, Pollution, and Politics," which examined economic and political pressures faced by environmental scientists attempting to assess and minimize mercury emissions from coal-fired power plants (Perkins, 2004). Although smokestack emissions far exceed ritualistic mercury releases, they pose only an indirect threat to human health via bioaccumulation in the aquatic food chain, whereas if elemental mercury is sprinkled on the floors of a home, "the apartment or dwelling certainly will become contaminated with mercury [and] subsequent inhabitants will never know they are facing the potential for continuing, potentially serious exposure to mercury" (Greenberg, 1999).

The failure of government to act on this issue is traceable in part to racial, ethnic, and religious factors inherent in ritualistic mercury use and to the absence of community advocacy. Embarrassment over the self-inflicted nature of the mercury contamination accounts in some measure for such absence. This combination of fear, embarrassment, and lack of community advocacy is well illustrated in Paul's article, "Mercury Rising" (2003), which additionally shows how anthropologists, environmental scientists, and physicians have allowed political pressures to influence their professional judgment. One anthropologist interviewed suggests that because remediation of mercury-contaminated dwellings is expensive, will lead to evacuations, and so will anger both the evacuated tenants and their landlords, "you have eventually solved nothing"; further, it intimates that the status quo of domestic mercury exposure be allowed to continue. A physician quoted as stating, "We may be dealing with tons of mercury going into the air, and here we are talking about ounces going into the environment through ritualistic use," ignores the fact that a small amount of mercury in a dwelling can result in dangerously high vapor concentrations. The same erroneous correlation of gross environmental pollution with individual health threat is to

be seen in the suggestion by an environmental health advocate that “a focus on ritualistic [mercury] use is a diversion from much larger sources of contamination . . . [such as from] coal-burning power plants and medical incinerators” (Paul, 2003).

A good example of how academics and medical professionals have elided and glossed over this issue can be seen in a major edited work on Latino health. Although the editors (Aguirre-Molina, Molina, and Zambrana, 2001) and chapter authors (e.g., Zambrana and Flores, 2001) were well aware of the magico-religious uses of mercury and had been provided with extensive documentation on the subject, their section on environmental health entirely omitted mention of the contamination of dwellings from ritualistic mercury use. Their sole reference to mercury exposure in the Latino community was that “[s]hops called *botánicas* . . . sell metallic mercury (*azogue*) as an ethno medical remedy” (Wendroff, 1990), this despite the facts that the reference they cited (1) bore the title “Domestic Mercury Pollution,” (2) made no mention whatsoever of mercury as an “ethno-medical remedy,” (3) repeatedly emphasized the hazards of maternal-fetal and pediatric mercury vapor exposure, and (4) ended with a suggestion that clinical, environmental, and sociological research into these exposures was “required to develop an effective health-education programme for *botánica* owners and their clients” (Wendroff, 1990).

The president of the Latin American Foundation for Environmental Protection in Miramar, Florida, stated that he “tried to reach the politicians to get a better grant for research, [as] its [ritual mercury contamination] a very serious issue. The reason I believe politicians don’t want to do anything about it is because the religious beliefs are too strong for politicians to get involved. My personal opinion is that they don’t want to touch that issue” (LaPeter and De La Garza, 2004). A spokeswoman for the Miami-Dade County Health Department echoed these sentiments: “We can talk about the health issues of mercury in general. . . . But when it’s something related to religion in rituals, it’s not something we deal with” (Fleshler, 2004). In 1993, 31 of 78 *botánicas* surveyed in Puerto Rico were found to be selling mercury (Nunez-Molina, 1993). The USEPA Region 2 and the Puerto Rican Ministry of Health have repeatedly been requested to investigate the environmental health impact of ritualistic mercury use in Puerto Rico, but they have failed to do so. A government-sponsored study in French Guiana found high hair mercury levels in ethnically Haitian women and children, “likely resulting from the use of mercury for religious rituals” (Cordier et al.,

1998), but no follow-up research was conducted to prove or disprove this hypothesis.

A further example of governmental ambivalence on this issue is the statement by the US Agency for Toxic Substances and Disease Registry (cited earlier) proclaiming “an urgent need” to determine levels of adult and child exposure to ritualistic mercury and recognizing that research on “a variety of exposure scenarios” is needed. Yet despite the proclaimed urgency of need, to date there has been no serious government-sponsored research to measure air mercury vapor levels inside living quarters in communities likely to be contaminated by ritualistic mercury use. At the recent USEPA-sponsored symposium, “Mercury: Medical and Public Health Issues,” a senior ATSDR science advisor only briefly discussed “ethnic and folk uses of mercury” (Risher and Amler, 2004). Over the past 15 years, many government environmental health professionals have privately expressed their reservations about government’s ability to substantively address this racially divisive, politically and fiscally explosive issue until there is significant demand for such intervention from the Caribbean and Latino communities themselves.

Recommendations

Sooner or later, government agencies and the environmental profession will have to respond forcefully to this looming environmental health disaster. At present, their denial that there is a serious problem has resulted in a lack of both conceptual and logistical infrastructure to deal with the need to assess very large numbers of homes for mercury contamination and even larger numbers of individuals for mercury exposure and absorption.

For the problem of ritualistic mercury contamination to be taken seriously by both the public health and the environmental health communities, *botánica* mercury sales must be correlated with domestic mercury contamination, with elevated body-mercury burden, and, ultimately, with pathology. There should be little technical difficulty in carrying out such research, but it is clear that without advocacy on the part of the affected communities, government will not allocate resources to gather the necessary data. Therefore, advocacy is the first requirement for conducting the necessary research. Advocacy will, in turn, come about only when the members of the Caribbean and Latino communities, especially community leaders, are, by a program of education, made fully aware of the health threat posed

to their infants, their children, and themselves by the use of ritualistic mercury in their homes.

To date, the standard biomarker of elemental mercury exposure has been the urine mercury level (Goldman and Shannon, 2001). As already noted, however, the validity of this measure for the low levels of mercury vapor likely to be the norm in contaminated dwellings ($<10 \mu\text{g}/\text{m}^3$) has recently been called into doubt (Tsuji et al., 2003). One possible response to this is to separate screening for mercury exposure from screening for mercury absorption. Total mercury levels in unwashed hair include mercury absorbed into the blood and incorporated into the hair structure and adsorbed mercury on the surface of the hair, which is indicative of ambient mercury exposure. Automated instrumentation, requiring no wet chemistry, can analyze hair samples for mercury content accurately, rapidly, and economically (Cizdziel, Hinnners, and Heithmar, 2002). Individuals with elevated hair mercury levels would then be further examined for signs and symptoms of mercury absorption and their dwellings screened for elevated levels of mercury vapor.

It is likely that a convincing demonstration that ritualistic mercury use has contaminated large numbers of homes will precipitate a demand for assessment and remediation that can only be met by government action. Accurate real-time assessment of mercury vapor levels below the $1 \mu\text{g}/\text{m}^3$ range will require large numbers of portable atomic absorption spectrometers (Garetano, 2004). Large numbers of such instruments will be needed in a mercury emergency, along with trained operators (Illinois Attorney General, 2000). Their lack is certain to be a major constraint in both assessment and remediation efforts. Public health and environmental health agencies should be acquiring them now.

When, under a functioning government program of assessment and remediation, dwellings are found to be contaminated with mercury vapor levels above $1 \mu\text{g}/\text{m}^3$, until remediation can be initiated it should be possible to postpone evacuation of occupants by the provision of some form of mercury-vapor filtration system. At least one manufacturer has developed such a filter for domestic use, which it claims is able to “remove mercury vapor from a 10ft² room, with carpeting in approximately 4 hours” (Siperstein, 2004). Such filters need to be further developed, tested, certified, and stockpiled. Their availability would greatly reduce the need for the evacuation of large numbers of dwellings, which in any event would likely prove impracticable, given the numbers of people involved and

the difficulty bound to be encountered in finding alternative accommodations for them.

The unhappy public health consequences of past violations of the Precautionary Principle should alone be sufficient to induce government to delay no longer in confronting the substantial threat to health posed by the ritualistic use of mercury in the home. Common prudence requires that, in concert with the public health and the environmental health communities, it act now.

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Magico-religious Mercury Exposure

Mark Wheeler's Focus article, "Measuring Mercury" (1), which appeared in the August 1996 issue of EHP, contained a serious omission. Wheeler concentrated on methyl mercury and, to a lesser extent, elemental mercury in dental amalgams. He failed to mention the relatively recently described but extremely significant exposures to elemental mercury in ethnically Hispanic and Caribbean homes, consequent to its use for a variety of magico-religious and ethnomedical purposes (2-3).

Such domestic use and presumed exposure has been documented in a number of published papers, as well as by research sponsored by the ATSDR (4-6) and the EPA (7). In fact, an ATSDR monograph specifically alerts clinicians to this exposure pathway: "Metallic mercury has been used by Mexican-Americans and Asian populations in folk remedies for chronic stomach disorders and by Latin-American and Caribbean natives in occult practices" (4). This monograph was edited by Thomas Clarkson, who was interviewed by Wheeler, and who has long been aware of elemental mercury's domestic use. Similarly, the EPA's Kathryn Mahaffey, also interviewed, has been aware of domestic mercury exposure for some years, and the EPA issued a risk assessment document on cultural uses of mercury in 1993 (7).

These mercury exposures are especially significant from an environmental health perspective because, in many cases, they are certain to be orders of magnitude greater than (methyl) mercury exposures from eating fish or from the leaching of mercury in amalgam fillings. Additionally, the mercury vapor released from mercury intentionally sprinkled on floors affects all occupants of contaminated homes, from the fetus to the elderly.

Andrew Rowland, cited in "The Issue of Amalgams" (1), has been aware of domestic mercury exposure for several years. Rowland makes a call for more research on health effects of amalgam-mercury exposure. I make a similar call for research on magico-religious mercury exposure. If the environmental health research community continues to ignore magico-religious mercury exposure, its health effects will never be ascertained.

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EL ENVENENAMIENTO CON MERCURIO

El mercurio se utiliza en todos los países de América para diversos ritos religiosos. Puesto que el público ignora en gran medida la naturaleza tóxica del mercurio, algunos de estos ritos dan lugar a la contaminación involuntaria de viviendas debido al vapor de mercurio¹. Aunque el mercurio se ha empleado durante muchos años en tales prácticas religiosas, una indagación en los documentos escritos al respecto no arroja ninguna referencia sobre la patología que se deriva de tal uso. Opino que esta carencia de una patología documentada no es indicio de la naturaleza inócua de estos ritos, sino más bien un reflejo del desconocimiento que tiene la profesión médica de esta práctica recién documentada y, subsecuentemente, de dejar de apreciar los signos sutiles de intoxicación crónica de mercurio en ambientes domésticos, al contrario de los ambientes industriales donde tal toxicidad se ha documentado desde hace mucho tiempo².

Estas prácticas religiosas se relacionan con religiones sincretistas, tales como la santería y el vudú, aunque no necesariamente forman parte integrante de la misma. En efecto, parece que el uso del mercurio pertenece más a los dominios de la magia popular que a la religión. El mercurio se vende en tiendas llamadas botánicas que expenden medicinas herbáreas así como artículos religiosos y ocultistas³. En Estados Unidos, los hispanohablantes suelen usar la palabra *azogue*, más bien que mercurio, que es un término mucho más común, para describir el Hg elemental que se usa con estos fines.

Una encuesta telefónica de 115 botánicas situadas en 13 ciudades de Estados Unidos y Puerto Rico, llevada a cabo por mi asistente la Srta. D. Her-

nández, encontró que 99 de ellas venden mercurio. Una encuesta semejante descubrió que también se vendía mercurio en Colombia, la República Dominicana y México. Y me han informado que en Haití, Perú y la mayoría de las otras naciones latinoamericanas el mercurio se vende mucho para las prácticas relacionadas con religiones populares.

De 29 botánicas visitadas en la ciudad de Nueva York, los propietarios de 14 de ellas recomendaron que el mercurio se use de un modo que puede tener probabilidades de contaminar la vivienda del usuario. La modalidad más común que se mencionaba es rociar el suelo con mercurio, y luego mezclarlo con jabón para lustrar el piso; o ponerlo en un tazón abierto, en algunos casos con un imán flotante. Todos estos usos tienen por objeto ahuyentar las malas influencias, tales como espíritus malignos y atraer las influencias benéficas, o ambas cosas.

El personal de las botánicas sugirió numerosos medios de usar el mercurio, entre ellos el de mezclarlo con perfume o colonia, colocarlo en el agua del baño, mezclarlo con amoníaco o alcanfor, portarlo como un amuleto o colgarlo de la pared para atraer el bien y repeler el mal.

Otro método mencionado por varias botánicas es colocar mercurio en el fanal de una vela. Parece como si esto diera lugar a la rápida vaporización del mercurio debido al calor de la llama. Sin embargo, un simple experimento mostró que muy poco mercurio se llega a escapar realmente a la atmósfera. En la práctica, la cera se derrite a una profundidad de 1 a 2 centímetros, y el mercurio se precipita a la zona sólida-líquida, de consiguiente no sólo desaparece

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de la llama, sino que queda cubierto por una capa de cera derretida que es relativamente impermeable al vapor de mercurio. Sin embargo, se necesitan medidas más precisas de las emanaciones del vapor de mercurio para determinar la seguridad de esta práctica potencialmente peligrosa.

No interrogamos a nuestros informantes en detalle, de manera que es posible que el mercurio se use de otros modos, y para otros fines. Uno de esos usos lo describió una experta en santería, quien dijo que el *azogue* se usa muchas veces como una especie de catalizador para aumentar la potencia de los amuletos destinados a atraer o a ahuyentar a miembros del sexo opuesto. Afirmó también que en su experiencia tales encantamientos se preparan invariablemente en vasijas cerradas tales como un coco o una jarra y, por tanto, es improbable que despidan vapor de mercurio en la atmósfera de la habitación. Sin embargo, posteriormente descubrí un libro sobre santería, con recetas para amuletos y fortuna, que utilizan el *azogue* de maneras que probablemente ocasionen que se libere mercurio en la atmósfera⁴. Estas recetas incluyen la colocación de mercurio en el bulbo ahuecado de un lirio, y en una lámpara de aceite, así como en un perfume, según lo describimos anteriormente.

Las botánicas suelen despachar mercurio en cápsulas de gelatina, y en algunas ocasiones en frascos de vidrio. Usualmente el precio es de \$1.00, y tanto el precio modal como medial de 41 muestras comparadas en la ciudad de Nueva York son de aproximadamente 8 gramos, oscilando entre 1,5 y 31,3 gramos. Un informante dice que en Perú se venden por cantidades significativamente mayores, y que se rocía el piso hasta con 20 ml. (0 270 g) a la vez. Es evidente que la cantidad de mercurio que se vende varía enormemente.

El dueño de una botánica, excusándose por no tener mercurio sugirió que compráramos un termómetro clínico y lo rompiéramos para extraerle el contenido de mercurio. El examen de 4 termómetros (2 orales y 2 rectales) de 3 marcas distintas arrojó que su contenido de mercurio oscila de .60 a .72 gramos, mucho menos de un décimo de dosis típica de mercurio que se despacha en una botánica.

Se considera que un microgramo por metro cúbico es el límite para la exposición crónica al vapor de mercurio⁵. Las cantidades de mercurio que suelen despachar las botánicas son más que suficientes para exceder ese límite cuando se rocían sobre el piso de una habitación normal. Los niveles del vapor del mer-

curio aumentan cuando el mercurio se aplica repetidamente, una práctica recomendada por varias botánicas. Los intervalos que se sugieren entre una y otra aplicación de mercurio varían de 3 a 7 días, que han de continuarse hasta obtener los resultados deseados. Tal práctica daría lugar a niveles atmosféricos muy elevados de vapor de mercurio.

Las concentraciones anteriores de vapor de mercurio se ven afectadas por una variedad de factores, entre ellos el tipo de construcción de la vivienda, altura sobre el nivel del suelo, tipo de superficie del suelo, temperatura ambiental y características de la ventilación, así como la cantidad, la frecuencia y el método de aplicación⁶.

Las botánicas mismas es probable que estén muy contaminadas, constituyendo un riesgo ocupacional para la salud de sus empleados⁷. En varias ocasiones hemos observado que los tenderos derraman mercurio mientras llenan frascos o cápsulas para la venta, sin que se cuiden de limpiar bien el mercurio del suelo. Una propietaria dijo que ella intencionalmente esparcía mercurio en su botánica a fin de "traer cosas buenas", y también añadía un poquito a cada receta que despachaba.

Otro modo en el cual el público se ve inconscientemente expuesto al mercurio es mediante una exposición de segunda mano, tal como ocurre cuando un inquilino esparce mercurio sobre el piso, y luego desocupa su departamento. Los residuos de mercurio, que se quedan en las grietas del piso, siguen evaporándose, y los nuevos ocupantes de la vivienda se ven expuestos sin saberlo al vapor de mercurio⁸. Clínicos dedicados a la investigación son por tanto incapaces de comprobar mediante un interrogatorio si tales individuos inconscientemente expuestos corren peligro. Métodos alternativos de investigación, tales como investigaciones que hacen mediciones de vapor de mercurio *in situ*, o exámenes aleatorios de muestras de orina, es probable que resulten prohibitivamente caros para la mayoría de los ministerios de salud pública. Además, hay una pobre correlación entre los niveles de mercurio en la orina y una patología. Esto presenta serios problemas para las autoridades sanitarias dedicadas a descubrir los casos y tratarlos.

Los individuos que corren mayor peligro de intoxicarse con mercurio son los niños pequeños y los fetos. Ambos sufren lesiones desproporcionalmente mayores debido a la exposición al mercurio que los adultos⁹, con secuelas que tienen mayores probabilidades de ser permanentes¹⁰. El vapor de mercurio

(Continúa en la Página 68)

CARAFATE[®]

(sucralfate) 1gm Tablets

CONTRAINDICATIONS: There are no known contraindications to the use of sucralfate.

PRECAUTIONS: Duodenal ulcers with sucralfate course of treatment. Special instructions: When sucralfate is absorbed in the stomach with other products, normal renal function is required. Patients with renal impairment will excrete sucralfate in the urine. Patients with renal impairment should be treated with caution. Patients with renal impairment should be treated with caution.

Drug Interactions: Sucralfate adsorbs many drugs, including tetracycline, digoxin, and other drugs. Sucralfate should be administered at least 2 hours before or after the administration of these drugs.

Adverse Reactions: Constipation, abdominal discomfort, indigestion, and other gastrointestinal effects.

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of sucralfate

While short-term treatment of the ulcer, a successful course of treatment is expected to alter the ulceration rate and healing time. Patients with renal impairment should be treated with caution. Patients with renal impairment should be treated with caution.

of FerriLily: Chronic oral administration of sucralfate to mice and rats at doses up to 50 mg/kg for 14 days had no effect on fertility. There was no evidence of teratogenicity in mice and rats at doses up to 50 mg/kg for 14 days. There was no evidence of teratogenicity in mice and rats at doses up to 50 mg/kg for 14 days.

of FerriLily: Chronic oral administration of sucralfate to mice and rats at doses up to 50 mg/kg for 14 days had no effect on fertility. There was no evidence of teratogenicity in mice and rats at doses up to 50 mg/kg for 14 days.

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EL ENVENENAMIENTO CON MERCURIO

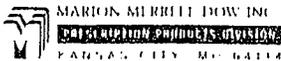
(Viene de la Página 66)

pasa tanto las barreras placentarias como hematoencefálicas¹¹, y se excreta en la leche materna¹². Además, el vapor es pesado, de manera que los infantes y niños que duermen, gatean o juegan en el piso se exponen a mayores concentraciones de vapor¹². Se ha reportado disminución de la libido, impotencia y trastornos en la espermatogénesis en obreros varones expuestos a vapor de mercurio¹⁴.

Es evidente que se necesita un empeño concertado para evaluar la extensión de este problema de salud recién reconocido. Se requiere investigación sociológica para indagar las creencias que se asocian con el uso del mercurio, así como la extensión de tal uso. El desarrollo de una eficaz campaña de salud pública es contingente a tal investigación sociocientífica. Se necesitan investigaciones epidemiológicas para evaluar los niveles de vapor de mercurio en viviendas y los niveles de mercurio en individuos, así como sus efectos patológicos. La puesta en práctica de tales programas, junto con restricciones legislativas a la venta de mercurio al público laico, deben ser tomadas en consideración por las autoridades sanitarias en todo el hemisferio.

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Domestic mercury pollution

SIR—Mills in his recent Scientific Correspondence¹ identified a previously unsuspected source of atmospheric mercury and speculated on its toxicity. Here, I report another novel source of mercury pollution in predominantly domestic settings, where it has hitherto been thought a rarity². I believe this is the first mention of widespread domestic exposure to mercury vapour.

Mercury metal is used in Latin American and Caribbean communities for occult purposes. It is sold in shops called botanicas which stock medicinal plants, magical medicines, incense, candles and perfumes³. These and other religious articles are dispensed to adherents of syncretistic Afro-Caribbean/Latin American religions, such as Santería and Voodoo, as well as to the general public.

In a survey of 115 botanicas in 13 cities with large Hispanic populations in the United States and Puerto Rico, 99 were found to sell mercury. A brief survey of botanicas in Mexico, Colombia and the Dominican Republic revealed that they too dispense mercury.

Botanicas typically dispense mercury in gelatin capsules, or occasionally glass vials. Of 41 samples purchased, the median amount dispensed was 8.5 g, with a mean of 9.0 g, a range of 1.5 to 31.3 g and a modal cost of \$1.00. Of 28 botanicas visited in New York City, 13 prescribed that mercury be sprinkled on the floor or mixed with soap and water used to mop the floor, to rid the house of evil influences or for other purposes. Some botanicas suggested repeated application at intervals of three days to a week, until the desired result is attained. One shopkeeper recommended placing mercury in an open container with a magnet. Any of these procedures would liberate mercury vapour directly into the room's atmosphere.

Several shopkeepers recommended that mercury should be carried on the person, kept in containers in the house, placed in bath water, or mixed with perfume, soap solutions or ammonia and camphor. Others prescribed placing mercury in devotional candles.

Mercury also presents an occupational hazard. My colleague twice observed shopkeepers spill mercury without removing or chemically neutralizing it. One proprietress said that she intentionally scattered mercury about her botanica to "bring good things", as well as adding a bit to each prescription she dispensed.

It is evident that the concentration of mercury vapour in room air will vary widely, depending on such factors as quantity dispensed, amount used, frequency of application, type of floor surface, air temperature, volume of room, height above floor level and ventilation. It is equally

apparent that the proposed $1 \mu\text{g m}^{-3}$ "upper limit for long-term exposure to mercury vapour in the air" cited by Mills¹ could easily be exceeded by repeated applications in a small apartment.

The most likely victims of these practices are young children, exposed to the highest levels of vapour as they sleep, crawl and play on contaminated floors^{4,5}. Mercury vapour enters the fetus via the placenta, and the infant via breast milk⁶. One result of mercury vapour's neurotoxicity on penetrating the blood-brain barrier⁷ is the subtle personality change called erethism. It seems likely that children are the principal victims of mercurial erethism, which is characterized by hostility, withdrawal, tendency to resent being observed, quick temper, loss of self confidence and loss of memory⁸. Sunderman's advice⁸ of "giving careful consideration to intoxication from undetected exposure to mercury . . . in patients

encountering depressions, behavioural and neurological disorders", is worth heeding, particularly in the evaluation of emotionally disturbed children.

There seems ample justification for a programme to measure mercury vapour levels and to test exposed individuals. Sociological research is also required to develop an effective health-education programme for botanica owners and their clients.

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Elemental Mercury Poisoning Presenting as Hypertension in a Young Child

Elizabeth H. Brannan, MD,* Sharon Su, MD,*† and Brian K. Alverson, MD*†

Abstract: Mercury intoxication is an uncommon cause of hypertension in children and can mimic several other diseases, such as pheochromocytoma and vasculitis. Mercury intoxication can present as a diagnostic challenge because levels of catecholamines may be elevated, suggesting that the etiology is a catecholamine-secreting tumor. Once acrodynia is identified as a primary symptom, a 24-hour urine mercury level can confirm the diagnosis. Inclusion of mercury intoxication in the differential diagnosis early on can help avoid unnecessary and invasive diagnostic tests and therapeutic interventions. We discuss a case of mercury intoxication in a 3-year-old girl presenting with hypertension and acrodynia, without a known history of exposure. Chelation therapy successfully treated our patient's mercury intoxication. However, it was also necessary to concurrently treat her hypertension and the pain associated with her acrodynia. Because there were no known risk factors for mercury poisoning in this case, and because ritual use of mercury is common in much of the United States, we recommend high clinical suspicion and subsequent testing in all cases of acrodynia.

Key Words: mercury poisoning/toxicity, hypertension, acrodynia, chelation therapy

(*Pediatr Emer Care* 2012;28: 812–814)

Elemental mercury intoxication is a rare cause of hypertension in children¹ but has potential for serious morbidity and can mimic several other serious conditions, including catecholamine-secreting tumors, Kawasaki disease, stimulant ingestion, and vasculitis. Elemental mercury intoxication affects, with varying degrees, the central and peripheral nervous systems, the cardiovascular system, the kidneys, the lungs, the gastrointestinal tract, and the skin, depending on the dose and chronicity of exposure.^{2,3}

In the 19th and early 20th centuries in the United States, children in particular were exposed to elemental mercury in the form of laxatives and diaper and teething powders.² Present-day sources of elemental mercury exposure include thermometers, disk batteries, fluorescent light bulbs, sphygmomanometers, latex paint, and dental amalgams, as well as certain cultural and religious practices and industrial processes.^{2–4} We present here a case of a child with elemental mercury intoxication that raises implications for the differential diagnosis and evaluation of hypertension in children and highlights the need for further evidence-based recommendations for treatment of mercury intoxication and interim management of mercury-induced hypertension and acrodynia.

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Disclosure: The authors declare no conflict of interest.

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CASE

A 3-year-old girl presented with 3 weeks of intermittent abdominal pain, diaphoresis, and tachycardia. Four days before admission, she developed pain in her hands and feet. On presentation she was hypertensive, with blood pressure of 158/100 mm Hg while calm. The patient's initial examination revealed a thin, diaphoretic girl with tachycardia and a hyperdynamic precordium, a diffusely tender but soft abdomen, and a normal result in the neurological examination aside from irritability. She had warm, erythematous, edematous palms and soles with intermittently appearing papules and desquamation, as well as a pruritic, erythematous, maculopapular rash over her chest and back. Her systemic symptoms were episodic throughout the day, and she appeared anxious during the episodes. Her extremity findings were consistent with acrodynia—an idiosyncratic hypersensitivity reaction to mercury exposure.⁵ On further examination of history, the patient's mother reported that there had been no fish ingestion in the last month. They also denied any broken thermometers in the house, burning of batteries or fluorescent lamps, contact with miners, steel workers, or with people working in cement factories or crematoria. They denied the patient had any recent ingestion of paint or new toys and stated that the patient did not regularly put toys in her mouth. The mother did, however, note that the family moved into a new apartment 2 months before presentation.

The patient had symmetrically elevated blood pressure in 4 extremities, unremarkable echocardiogram and electrocardiogram, and a normal result on fundoscopic examination. Her initial electrolytes, creatinine, and urinalysis were all normal and remained so on serial evaluations. Urine drug screen was negative. Thyroid function panel and levels of renin and aldosterone were normal. An abdominal plain film was unremarkable. Plasma metanephrine and plasma and urine catecholamine levels were elevated, suggestive of pheochromocytoma (Table 1). A magnetic resonance imaging (MRI)/angiography of the abdomen and MRI of the chest and pelvis showed no masses or renal artery stenosis, and an MRI of the brain and neck showed no masses or other abnormalities. Given the patient's persistent hypertension, tachycardia, diaphoresis, irritability, acrodynia, and elevated catecholamine levels without evidence of a tumor on imaging, mercury toxicity was suspected, despite absence of any known exposure. A 24-hour urine mercury sample was elevated at 60 μg (reference range, 0–20 $\mu\text{g}/24$ h).

The patient was started on oral chelation therapy with dimercaptosuccinic acid (DMSA) 16 mg/kg divided twice daily. Her hypertension was controlled with labetalol and amlodipine. One week after initiation of therapy, her urine mercury level rose to 178 μg , but after 2 weeks on therapy, it began to drop and she was continued on therapy for approximately 2.5 months (Fig. 1). Creatinine levels and results in liver function tests during chelation therapy remained normal. She required antihypertensive therapy for 2 months. At 3 months of follow-up, the patient was normotensive off medication, her acrodynia and irritability had resolved, and plasma metanephrine levels normalized.

TABLE 1. Laboratory Evaluation

Free T ₄ (reference range, 0.8–1.8 ng/dL)	1.8 ng/dL
TSH (reference range, 0.35–5.5 uIU/mL)	3.85 uIU/mL
Plasma renin activity (reference range, 100–650 ng/dL per hour)	542 ng/dL per hour
Aldosterone (reference range, 2–37 ng/dL)	16 ng/dL
Plasma	
Total metanephrine (reference range, ≤205 pg/mL)	424 pg/mL
Normetanephrine (reference range, ≤148 pg/mL)	392 pg/mL
Dopamine (reference range, 0–135 pg/mL)	<20 pg/mL
Norepinephrine (reference range, 0–600 pg/mL)	1474 pg/mL
Epinephrine (reference range, 0–90 pg/mL)	149 pg/mL
24-h urine	
Total metanephrine (reference range, 0–900 µg/d)	797 µg/d
Norepinephrine (reference range, 4–29 µg/d)	119 µg/d
Epinephrine (reference range, 0–6 µg/d)	33 µg/d
Dopamine (reference range, 40–260 µg/d)	284 µg/d

T₄ indicates thyroxine; TSH, thyroid-stimulating hormone.

The state Department of Health was notified when the patient’s urine mercury level returned elevated, and investigation by the Department of Environmental Management revealed elevated mercury levels throughout the home and levels above 30,000 ng/m³ in the master bedroom, whereas a limit of 1000 ng/m³ has been set as the safe level for occupancy. Neighbors reported that the previous tenant was a Columbian woman who practiced rituals in the home that involved the use of mercury. Such practices are well described in the literature, and elemental mercury is obtainable at community botanicas.⁴

DISCUSSION

This case report highlights the importance of including mercury intoxication in the differential diagnosis of children with hypertension, even in the absence of known exposure, and particularly when symptoms suggest pheochromocytoma. Mercury interferes with the catabolism of catecholamines by inactivating a coenzyme used by catecholamine-*O*-methyltransferase, resulting in accumulation of norepinephrine, epinephrine, and dopamine in the blood and urine.¹ This is responsible for both the pheochromocytoma-like symptoms (hypertension, diaphoresis, tachycardia) and the laboratory findings (elevated levels of plasma and urine catecholamines and metanephrines) associated with mercury intoxication. Mercury intoxication should be considered in any child in whom a catecholamine-secreting tumor is suspected.

In this particular case, with no tumor visible on MRI and before the result of the urine mercury level, the diagnosis of erythromelalgia was also considered. Erythromelalgia is a rare condition composed of episodic erythema, warmth, and burning pain in the extremities.⁶ Primary erythromelalgia can begin spontaneously at any age, and new research suggests a hereditary component involving mutation in the Na_v1.7 voltage-gated sodium channel.⁷ Secondary forms are associated with underlying illness such as myeloproliferative and autoimmune diseases. Symptoms are triggered by warm temperatures, and patients often find relief by cooling the affected extremities. Interestingly,

our patient did find comfort in running her hands under cold water. The pathophysiology has yet to be fully characterized but is believed to be due to vascular shunting and reactive hyperemia.⁶

Management of this patient’s hypertension was complicated by the combination of increased sympathetic nervous system activity and persistent pain resulting from this patient’s acrodynia. In addition, the choice of antihypertensive agents had an impact on imaging modalities. Given that her symptoms were most suggestive of an elevated catecholamine-like state, labetalol was chosen because of its combined blockade of α- and β-adrenergic activities. Selectively blocking only α- or β-adrenoreceptors can result in overstimulation of the unblocked pathway, so it is recommended that both adrenoreceptors be inhibited. Her blood pressures were only partially controlled on labetalol. When imaging failed to demonstrate a tumor and vasculitis was suspected, calcium channel blockers (CCB)—amlodipine and isradipine—were added to her antihypertensive regimen. It was postulated that hypertension from vasculitis may result from endothelial dysfunction of the vasculature, and CCBs may inhibit this process. When no laboratory data supported a diagnosis of vasculitis, meta-iodobenzylguanidine (MIBG) scan was considered to identify any catecholamine-secreting tumor. However, labetalol and CCBs have been shown to reduce uptake of MIBG and lead to false-negative scans,⁸ so there was consideration of switching her to other blood pressure agents, such as an angiotensin-converting enzyme inhibitor and a vasodilator. Fortunately, her urine mercury level came back elevated, and a MIBG scan was no longer indicated.

Hypertension resulting from mercury toxicity often requires more than 1 class of antihypertensive medication. Case reports have described the simultaneous use of up to 4 different antihypertensives.^{1,5} Our report describes the successful management of this patient’s hypertension with the dual therapy of labetalol 4.5 mg/kg per day and amlodipine 0.4 mg/kg per day. The emphasis placed on adequate pain management and the use of topical mexiletine to the hands and feet and oral gabapentin may have contributed to the successful control of her blood pressures.

In the literature, nephrotoxic effects from mercury exposure often present as nephrotic syndrome.^{9–12} Occasionally, reversible renal tubular dysfunction has also been reported.¹³ Fortunately, the patient did not develop either sign of renal toxicity. There is no specific therapy to treat the nephrotoxic effects of

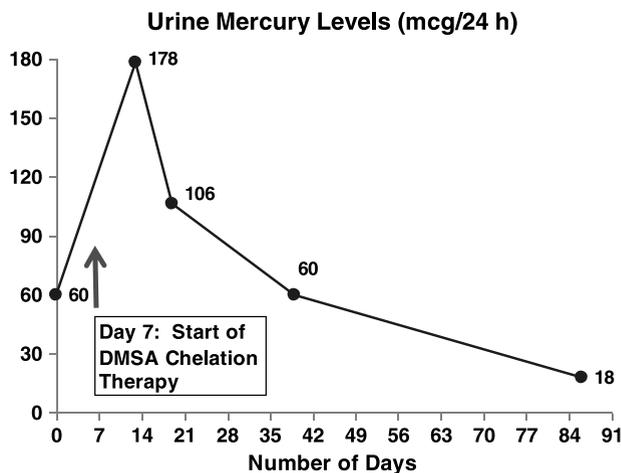


FIGURE 1. Urine mercury levels from diagnosis through treatment with DMSA.

mercury poisoning, but removal of the heavy metal by chelation can reverse the nephrotic syndrome and tubular defects.^{14,15}

The patient received chelation therapy with DMSA. As expected, her urine mercury level initially rose on starting chelation therapy (Fig. 1) because the mercury was liberated from her body tissues, but then it began to drop and eventually normalized. Of note, DMSA is the most frequently used oral chelation therapy for mercury toxicity in children, but treatment remains controversial, and several studies suggest no clear clinical benefit of chelation with DMSA in people with elemental mercury poisoning.¹⁶ Some suggest that natural clearance of mercury in the urine follows a linear 1-compartment elimination model.¹⁷ In our case, the fact that the urine levels rose after DMSA administration implies that chelation was effective.

Clinical suspicion for mercury toxicity should remain high in the absence of risk factors. The use of mercury in religious practice is well described; however, the extent of this problem is hard to understand or measure.¹⁸ Sale of elemental mercury from botanicas for the purposes of sprinkling about the home is not uncommon.^{4,19} One screening study in New York City demonstrated that 5% of healthy pediatric volunteers had unexpected elevated urinary mercury levels.²⁰

CONCLUSIONS

This case illustrates that evaluation for mercury exposure should be considered when there is presentation of hypertension and acrodynia, even in the absence of a known exposure. Selection of appropriate antihypertensive medications in the setting of increased catecholamines is challenging given the diagnostic possibilities. Management of mercury toxicity includes not only chelation therapy but also supportive care, particularly providing adequate pain control for the patient. The availability of elemental mercury at community botanicas and its use in cultural practices also represents a public health concern that warrants further attention.

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THE CITY OF NEW YORK
DEPARTMENT OF HEALTH
OFFICE OF THE COMMISSIONER



125 WORTH STREET
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January, 2000

NEAL L. COHEN, M.D.
COMMISSIONER
TEL (212) 788-5261
FAX (212) 964-0472

Dear Colleague:

Enclosed is a brochure developed by the New York City Department of Health describing a route of exposure to metallic mercury that may affect some of your patients. It has been reported that in some Latin American and Caribbean communities in the city, metallic mercury available in botanicas and religious stores is used in religious or ethnomedical practices in a manner that may adversely affect health.

The type of damage to the body caused by this form of mercury is dependent on how much and for how long a person is exposed to it. Mercury vapors can persist in indoor environments for long periods of time, and, because the vapors are invisible, people who live in or regularly visit homes where mercury is used may not be aware that they are being exposed. Unfortunately, metallic mercury has the greatest effect on the developing central nervous systems of fetuses and young children.

In order to ensure the well-being of your patients and their families, they should be made aware of the potential dangers of mercury use. You can respect your patients' religious and cultural beliefs and still provide effective care. The first step is to ask patients about their use of traditional/folk treatments and whether they use metallic mercury. The enclosed brochure includes more information on the health effects of mercury, how to test for absorption and how to address patient concerns.

In addition, the New York City Department of Health has prepared patient-education brochures in English, Spanish, and Haitian Creole. Sample copies are enclosed. Please call (212) 788-4290 to request additional copies. Thank you for your attention to this problem and your efforts to improve the health of all New York City residents.

Sincerely,

Neal L. Cohen, M.D.
Commissioner

NLC/nj

justice health issues with attention to institutional and corporate health care providers, federal grants, and centers

Health Resolution No. 4:

NEJAC requests that OPPTS and OECA examine and report back at the next meeting the extent to which mercury poisoning associated with domestic use in cultural practices is a health problem, and where the responsibility lies within the federal agencies to address this issue.

Health Resolution No. 5:

The Health and Research Subcommittee supports the recommendations made by the Waste and Facility Siting Subcommittee on the National Academy of Sciences/Institute of Medicine Environmental Justice Study.

Health Resolution No. 6:

NEJAC: 1) urges OEJ to serve as the focal point for developing a comprehensive database of environmental justice contacts, and 2) suggests that OEJ provide updated environmental justice mailing lists to any EPA office issuing requests for proposals that deal with environmental justice concerns.



**TASK FORCE
ON
RITUALISTIC USES OF MERCURY
REPORT**

TASK FORCE ON RITUALISTIC USES OF MERCURY REPORT



DISCLAIMER

THE OPINIONS EXPRESSED IN THIS REPORT ARE THOSE OF THE TASK FORCE MEMBERS AND OTHER PARTICIPANTS IN ITS ACTIVITIES. THEY ARE NOT NECESSARILY THE VIEWS OF THE ENVIRONMENTAL PROTECTION AGENCY, THE AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY, THE CONSUMER PRODUCT SAFETY COMMISSION, OR ANY OTHER PARTICIPATING ORGANIZATION.

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EXECUTIVE SUMMARY

The U. S. Environmental Protection Agency's (EPA) Office of Emergency and Remedial Response (OERR) convened the Task Force on Ritualistic Uses of Mercury in January 1999 to recommend an appropriate course of action regarding the use of elemental mercury as part of certain spiritual practices and folk traditions. In forming the multi-agency task force, EPA hoped to gain a better understanding of these practices and traditions and their potential public health and environmental impacts. This report summarizes the Task Force activities, provides an overview of what is known about cultural and spiritual mercury use, and makes recommendations for further investigation, outreach, and action.

Scope of Problem: Availability, Use, and Exposure

In many urban areas in the United States, religious supply stores known as *botanicas* sell a variety of herbal remedies and religious items used in certain Latino and Afro-Caribbean traditions, including Santería, Palo, Voodoo, and Espiritismo. The involved religions evolved from native faiths brought to the New World by African slaves. It is important to note that these religious practices were vigorously suppressed by the slave owners over hundreds of years. Their survival, in fact, was only assured by disguising them as European religions. Thus, many of the religious figures and deities were renamed after Catholic saints, but retained many of the roles consistent with the original African beliefs. It is not surprising that after so many years of religious oppression, these groups might be sensitive toward scrutiny by those in authority.

A number of studies have documented mercury's availability for purchase in many *botanicas*. Mercury is used to attract luck, love, or money; to protect against evil; or to speed the action of spells through a variety of recommended uses, including wearing as amulets, sprinkling on the floor, or adding to a candle or oil lamp. It is sometimes taken internally to treat gastrointestinal disorders, or added to detergent or cosmetic products. Data gathered to date on availability and use of mercury are largely based on self-reports, with small or non-representative samples. Not enough attention has been given to characterizing populations that use mercury. The extent of use across the population, and typical use patterns for individuals are still unknown. Little is known about how mercury is supplied to *botanicas* for retail sale. Scientific aspects, such as the fate and transport of mercury vapor indoors, are also not well understood. There is no clinical data that confirms that people who use mercury for cultural and spiritual purposes (and people who share their living space) have elevated mercury levels. However, no one has formally studied this question, and socioeconomic and political barriers inhibit reporting of health problems related to cultural and spiritual mercury use. Actual measurements of mercury concentrations in indoor air in *botanicas* and residences are also necessary to gauge the severity of the problem, and to relate source and exposure data.

Nonetheless, mercury's volatility and long residence time indoors create a potential for direct inhalation exposures to individuals from these uses. Mercury is difficult to remove from home materials, and small amounts can lead to contamination for extended periods of time. Its widespread availability in *botanicas* suggests that indoor mercury exposure may be a problem for some users and their families.

Health Effects

In short-term exposure (on the order of hours), mercury first affects the respiratory system and can result in pneumonitis, severe bronchiolitis, pulmonary edema, and/or death. With smaller doses over a longer period of time (e.g., occupational exposure where workers are exposed for many years), neurologic effects predominate. These effects may include intention tremors, emotional lability, insomnia, memory loss, neuromuscular changes, headache, ataxia, polyneuropathy, and deterioration of performance in tests of cognitive function. Because of their variability and nonspecificity, these chronic neurologic effects may be misdiagnosed as behavioral or psychiatric disorders. The long-term health effects in children with elevated urine mercury levels have not been well studied. However, for any given overall household air concentration, children may be at higher risk of toxicity than adults.

Measurement of inorganic mercury in the urine is the most widely accepted method of monitoring for toxic levels of exposure and most closely reflects the body burden of the substance, especially in chronic exposures. However, for a number of reasons, interpretation of urine mercury levels is not always straightforward. Although a number of studies have found adverse neurotoxic effects at higher urinary mercury levels, the lowest mean chronic urinary mercury levels at which adverse health effects have been demonstrated in humans are close to the upper background value of 20 micrograms per liter ($\mu\text{g/L}$).

Task Force Recommendations

A number of federal, state and local agencies have acted over the past decade to gain a better understanding of the problem and to reduce mercury exposure from spiritual and cultural practices. Actions have included informal and formal information gathering, meetings with community groups, production and distribution of health alerts and outreach materials (including fact sheets, sample labels, Web sites, brochures, radio announcements, and press releases), investigation of complaints, research funding, risk assessments, voluntary product recalls, measurements of mercury air levels in *botanicas* and surrounding living areas, and enforcement of applicable regulations, ranging in scope from letters to potential violators to a 1991 order banning the packaging of mercury in small vials for sale in Puerto Rican *botanicas*.

The Task Force recommendations seek to reduce mercury exposure by recommending realistic and cost-effective actions that will promote health and well-being while respecting cultural traditions and community autonomy. The Task Force recommends approaches that rely primarily on community outreach and education activities to inform mercury suppliers and the public about mercury's risks, and encourage the use of safer alternatives. Because there continues to be a paucity of data on the extent of use of mercury for these purposes, the fate and transport of mercury indoors, and the exposure that might result from these uses, the Task Force prioritized a number of areas for further study and research. The Task Force recognizes there are many competing priorities for research, and that government agencies, and non-governmental organizations must balance these recommendations against other existing priorities. The Task Force made the following recommendations:

I. Community Outreach and Education

A coordinated effort between state and local health departments and local community organizations can help inform mercury suppliers and the public about mercury's risks. Federal agencies can play a supportive role in these activities.

EPA/OERR

1. Develop a brochure on mercury describing its hazards and what to do if mercury is spilled. This brochure will serve as a template that can be used by local groups in designing their own communications. The brochure is intended primarily for distribution via the Web.
2. Produce a written statement for distribution to community groups on the do's and don'ts of mercury use. This was widely requested by forum participants, this "official message" should also include messages from the brochure and emphasize the importance of community leaders in outreach.
3. Encourage funding to assist community-based organizations (CBOs) and local health departments involved in outreach and education activities.
4. Work with various EPA offices to incorporate mercury in existing education programs, where appropriate. Because of the perceived success of programs addressing lead and asthma, there was general support for incorporating the issue of mercury and its health effects into existing programs in the Office of Children's Health, the Office of Indoor Air, and the Office of Toxics. It would be particularly effective to add cultural mercury use issues to the indoor air hotline, and to EPA's Tools for Schools kit.

Agency for Toxic Substances and Disease Registry (ATSDR)

1. Encourage state and local health departments to partner with CBOs in their area and develop an effective outreach strategy.
2. Encourage the addition of the issue of mercury to existing education programs, where appropriate. There was general support for incorporating the issue of mercury and its health effects into existing programs that deal with similar health issues, such as Indoor Air Quality Programs (e.g., carbon dioxide and lead); Asthma Programs; and Prenatal Care Programs. The Woman, Infants, and Children (WIC) approach is a good model. Mercury exposure questions should be included on the National Health and Nutrition Examination Survey (NHANES) and the Hispanic Health and Nutrition Examination Survey (HHANES). Secondhand exposure should be included in another line of questioning, such as how long has the exposed person lived in their residence, etc. Early education childhood prevention programs should follow or be attached to lead questions.

Regions/Local Health Departments/CBOs

Plan, implement, and evaluate local education and outreach activities. Much of the outreach and education on mercury use is necessarily local. Forum participants agreed that grassroots education efforts are most likely to be effective. Although federal agencies can provide general guidance about the content of a warning message about mercury use, it is up to state and local health departments working with CBOs to tailor the message to the local audience and deliver the message effectively. The collective wisdom compiled from the participants in the forum on Ritualistic Uses of Mercury on conducting outreach and education can be found in section 4.5. There was consensus that partnerships between local and state health departments and CBOs are most effective at promoting mercury programs.

Community-Based Organizations

1. Communicate with publishers and authors of religious/spirituality books that contain mercury spells, to request inclusion of a specific note about the risks of using mercury and how to reduce risk in practice – or a consideration of alternative spells that use non-toxic substances.

II. Research Agenda

The following key research areas should be prioritized against other existing priorities:

1. Clinical studies to identify elemental mercury levels in people. Ideally, levels of mercury would be examined in the bodies of mercury users versus a control group. Twenty-four hour urine mercury samples could be obtained rather than spot samples, and the mercury could be speciated. Follow-up would connect exposures to particular sources and use patterns. Given the real-world constraints imposed by funding issues and the stigma associated with cultural mercury use, some modifications will have to be made. For example, anonymity and the convenience associated with spot-urine sampling are needed to attract participants. A simplified research strategy might only consider base screening mercury levels in Latino and Caribbean communities versus other communities. Although researchers should strive toward detailed measurement studies where possible, the studies should, at a minimum, measure the incidence of exposure and impact of mercury on the community. Incorporation of mercury tests into other routine tests – for example, child blood-lead levels – might be an effective way for local clinics to collect useful data. ATSDR has Institutional Review Board (IRB) guidelines that govern clinical studies involving human subjects, and these must be followed for any clinical study.
2. Ethnographic research to identify the needs, beliefs, use and exposure patterns in specific subpopulations, and to understand the frequency and extent of different uses, sales rates, and mercury supply chains. Such research would better characterize the mercury-using population, illuminating how mercury is used and its exposure implications, as well as its cultural meaning or significance. Identifying safe alternatives for mercury used by practitioners in a variety of cultural and religious contexts is also desirable. Participant observation should be a particularly effective research tool for this work.

3. Risk perception and risk communication research that evaluates the effectiveness of communication materials and outreach strategies, and provides input for improved designs for both. Market research approaches are also valuable here in understanding the audience and designing salient messages with immediate practical application. Stakeholders should be involved in ongoing discussions of risk management, and in the design and evaluation of risk communication materials.
4. Fate and transport studies of mercury in indoor air to better relate cultural use to acute and long-term exposure levels, and to develop models to predict indoor concentrations and residence times. Air measurements in vehicles, residences and *botanicas* are needed to validate these models and measure typical exposure levels stemming from cultural and religious uses.
5. Epidemiology and toxicology studies aimed at understanding low-level health effects of mercury and exploring novel biomarkers for exposure assessment are needed. Small grants (such as those provided in the past by ATSDR and EPA Regions 2 and 5), will be sufficient and effective for sharing key information for most of these studies. Priority should be given to proposals that represent true collaborations with active involvement of community groups with demonstrated access to exposed populations. Private foundations may be a source for funding on this issue. Some academic professional organizations in sociology and anthropology may provide small grants for new projects in this field. Finally, the federal and state health care and clinical health community may be an additional funding source for many of these studies. The Office of Minority Health in the Department of Health and Human Services, for example, may have an interest in some of these research areas.

III. Environmental Monitoring

EPA

1. Provide guidance on the use of generally accepted ambient levels of mercury.
2. Provide guidance on instruments and detection limits to use when sampling for mercury. The NIOSH 6009 method is the standard method used to monitor for mercury. Newer instruments have been developed that are more portable, and can provide faster and cheaper measurements. Guidance is needed on the use of these newer instruments to ensure their precision and accuracy when compared against the standard NIOSH 6009 method.
3. Provide guidance on action levels of mercury.

IV. Technical Assistance and Response

1. Any clinical response must meet ATSDR's criteria for an environmental health intervention and would require environmental data that would meet the criterion for a public health hazard. If these conditions are met, a response framework would be constructed. ATSDR is prepared to provide guidance in public health practice through ascertaining the public health implications of exposure scenarios and the development and adaptation of the current response strategy. ATSDR

is ready to assist in developing an integrated risk management protocol based on environmental and biological sampling, should one become necessary in the future. Any cleanup response to mercury releases on the Federal level must be pursuant to the legislative and regulatory authorities of Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

PREFACE

The U.S. Environmental Protection Agency (EPA) convened the Task Force on Ritualistic Uses of Mercury in January 1999 to recommend an appropriate course of action regarding the use of elemental mercury as part of certain folk practices and religious traditions. In forming the multi-agency Task Force, EPA hoped to gain a better understanding of these practices and traditions and their potential public health and environmental impacts. This report summarizes Task Force activities, provides an overview of what is known about cultural and spiritual mercury use and makes recommendations for further investigation and outreach.

Mercury is a well-known and much-studied toxic substance. The Task Force designed its work to complement EPA's broader agenda to reduce mercury in the environment. These EPA efforts focus primarily on reducing: 1) releases from coal fired power plants, 2) consumption of methylmercury in fish, and 3) the use of mercury in schools and medical facilities. Indoor domestic exposure to mercury vapor is of significant concern because of its potential for direct impact on human health. A variety of sources can lead to domestic exposure, including improperly removed gas pressure regulators, broken thermostats and thermometers, mercury manometers, and children releasing stored mercury. In response to repeated requests from Dr. Arnold Wendroff of the Mercury Poisoning Project in Brooklyn, New York, EPA formed the Task Force to gain a better understanding of cultural and religious uses of mercury.

The Task Force identified the following purposes as its scope of work:

- To share information about ongoing efforts to evaluate the extent of the problem and related education and outreach activities;
- To recommend a research agenda to better define the extent of distribution and problems resulting from cultural and spiritual uses of mercury;
- To recommend a community-based strategic plan for education and outreach activities that informs users and those exposed to mercury of the hazards of cultural and spiritual uses of mercury and that encourages reduced exposure; and
- To recommend public health and environmental management protocols, if needed. The protocols would cover health education activities and outreach to affected populations, and identify tiers of action to determine if a response is needed. The protocols would identify a broad base of organizations and agencies who could assist in implementing the protocol.

Accordingly, this report presents the current state of knowledge about these practices and their health effects, discusses the key areas where additional knowledge would be a helpful guide for decision makers, and develops a framework for a community-based public health plan addressing cultural mercury uses.

Report Organization

This report is organized into six chapters. Chapter 1 gives an overview of the problem in its cultural and political context, identifying the practices involved and the exposures that can result. Chapter 2 provides detailed background on the health effects of mercury exposure. Chapter 3 discusses the

policy history of cultural and religious mercury use, detailing actions of federal, state, and local agencies since 1990. Chapter 4 describes the activities of the Task Force, including the forum it hosted in May 2001. Chapter 5 evaluates the full range of options available to regulators in addressing this issue, with a focus on EPA, and the likely consequences of each action. Chapter 6 recommends a course of action for research and outreach.

ACKNOWLEDGMENTS

A great number of people have contributed to the work of the Task Force.

First, Peter Redmond, Allen Maples, and Geri Bell served the Task Force as Chairs, providing leadership and guidance in our discussions and actions. Laurie Ann Columbo served as chair of the Outreach and Education subcommittee, Erik Auf der Heide as chair of the clinical intervention subcommittee, and Clyde Johnson and Craig Beasley as chairs of the environmental sampling subcommittee. We thank Suzanne Wells for her support of the Task Force's activities.

Several people contributed to the writing of this report. Donna Riley, an American Association for the Advancement of Science (AAAS) fellow at EPA wrote the bulk of the report. Erik auf der Heide wrote Chapter 2 in its entirety. Maureen Lichtveld contributed the framework for the outreach and education recommendations. Clyde Johnson contributed the discussion on environmental monitoring. Karen L. Martin incorporated final comments on the report, and prepared it for printing.

The Task Force built on the foundation of work done previously at EPA by Mary Dominiak, Greg Susanke, Andrea Blaschka, and Sam Gutnik in OPPTS, and Kim Fletcher in CIOC. We are grateful for their continued assistance.

We are grateful to the community members who took the time to meet with Task Force representatives at the National Alliance for Hispanic Health, the Temple of Yehwe, the League of United Latin American Citizens, the Latin American Youth Center, the Pan-American Health Organization, and the American Public Health Association. We acknowledge with gratitude the hard work of Dr. Arnold Wendroff of the Mercury Poisoning Project, a tireless advocate for more than a decade, who first brought national attention to this issue; without him this Task Force would not have existed.

We thank the Marasco Newton Group, especially Erin Hogan and Brian Ellingwood, for their support.

We acknowledge on the following two pages the active participants in Task Force activities, and many others who have supported our work.

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1. PRACTICES AND EXPOSURE

1.1 Terminology and Focus

The Task Force on Ritualistic Uses of Mercury initially chose the term “ritualistic” to refer to uses of mercury that are ceremonial or religious in nature, or that occur according to social custom. Although this is exactly what the term ritualistic means, the Task Force discovered in the course of its work that the term seems to carry some negative connotations that were not intended.

Although the Task Force has retained its name, the language in this report consistently refers to “cultural,” “religious,” “folk medicinal,” and “spiritual” uses of mercury, as preferred language, recognizing that this language is also imperfect.

Although the Task Force remains concerned about mercury exposure stemming from uses in any cultural or spiritual tradition, its attention was drawn to the widespread availability of mercury in *botanicas* – shops that supply folk medicines, religious artifacts, and other cultural goods in Latino and Caribbean communities.

1.2 Availability

In many urban areas in the United States, religious supply stores known as *botanicas* sell a variety of herbal remedies and religious items used in Latino and Afro-Caribbean traditions, including Santería, Palo, Voodoo, and Espiritismo. Many *botanicas* sell mercury (also called *azogue* or *vidajan*) for individual use in homes, as part of these traditions.

A 1995 survey of 41 New York *botanicas* found that 38 reported selling mercury, most of them at a rate of one to four capsules a day[1]. An earlier survey of 115 *botanicas* in 13 cities in the United States and Puerto Rico found that 99 sold mercury[2]. The Chicago Department of Public Health visited 16 *botanicas* in local Latino communities; all 16 sold mercury in capsules (average weight of ½ oz.)[3]. Twelve of the *botanicas* sold the mercury without any sort of labeling. The other four provided English and Spanish warning labels, although the information was incomplete.

As awareness of mercury exposure has increased in certain areas through the efforts of public health officials, researchers have found that mercury is more difficult to obtain from *botanicas*. However, the sale of mercury seems merely to have been driven underground, so that establishing oneself as an insider will substantially increase the likelihood of a mercury sale, either on site or at a secret location[4].

Mercury is commonly sold in a large gelatin capsule that contains, on average, about 9 grams of the metal[2]. Larger quantities are less commonly sold in small jars or plastic bags.

In addition to *botanicas*, plumbing supply stores sell elemental mercury for use in manometers. Mercury may also be available through mail order, over the Internet, and in some hardware stores and markets, called *bodegas*, in Caribbean and Latino neighborhoods.

The availability of mercury needs to be better characterized. To properly characterize the extent of exposure, more information is needed to estimate the volume of mercury sales, the number of *botanicas* that sell mercury now (the limited studies available are several years old), and the amount purchased per customer. Based on a recent report in the Chicago Sun Times, mercury sales appear to have declined[5]. Have mercury sales actually slowed there, or have they moved underground? How has this change affected the extent of mercury use in that community? More generally, how is mercury availability related to its use? All of these questions need further investigation.

1.3 Uses

Mercury is used in a variety of ways to attract luck, love, or money; to protect against evil, or to speed the action of spiritual works, as proposed by spiritual or folk traditions. Popular books on Santería feature “recipes” for spiritual works that contain mercury[6],[7]. Zayas and Ozuah[1]found that *botanica* personnel most commonly recommended carrying mercury as an amulet in a sealed pouch (49%) or pocket (32%), or sprinkling mercury in the home (29%). A survey of Latin American and Caribbean residents of the Bronx[8]reported these uses as well as burning mercury in a candle, mixing it with perfume, and sprinkling it in the car. Wendroff[2]reported that 13 of 28 New York *botanicas* prescribed sprinkling mercury indoors. Ingestion of mercury has also been documented in Mexican American communities as a treatment for the culturally bound intestinal disorder empacho[9],[10]. Mercury is sometimes mixed with water or other liquids and used to clean the home, added to spiritual baths, or placed under the bed in a cup of water[1, 2, 4, 8].

The extent of mercury use is unknown, but several studies have collected data that indicate its use is prevalent in some areas. Johnson[8]surveyed 203 Latin American and Caribbean adults in New York City; 44% of Caribbean and 27% of Latin American respondents reported mercury use. Six percent of Latin American and 12% of Caribbean mercury users said they used it daily; 54% of Latin American and 50% of Caribbean mercury users said they used it occasionally. It is of interest that nearly two-thirds of the user and non-user respondents (with no significant difference between the two groups) said they would welcome having indoor air measurements or biological testing for mercury. Eighty-two percent said they obtained elemental mercury from a *botanica*; 3% brought it with them when they emigrated to the United States; 6% got it from their job, a pharmacy, their landlord, or their parents; and 9% did not specify a source.

A survey in Hartford Connecticut, conducted by the Hispanic Health Council, found that of 108 Latino and West Indian residents of Hartford, only 8% reported using mercury, while 17% knew of its use. Of 10 spiritists and folk healers interviewed, only one reported currently using mercury in the home, although all knew about the practice (Toal B. Connecticut Department of Health. Personal Communication, August 2, 2001.). Zayas and Ozuah[1]found that the source of recommendation for mercury use was reported as a family member (39%), spiritualist (39%), or friend (37%), while *santeros* (Santería priests) were mentioned by only 10%. In a survey of 79 Latino residents of Chicago, Illinois, 16 (1 male, and 15 females) reported that they had used metallic mercury on several occasions. Half knew someone outside of the family, who used mercury and one-fourth knew someone within the family, who it. One of the 16 reported current use of

mercury at least once a month, three reported using it during the prior year, and 12 said they used it more than a year ago[3].

Wendroff describes in an unpublished study carried out in fall 1990 by Dr. Deborah Arbit, a chief resident at the State University of New York-Downstate Medical Center. A survey of 100 women patients, mostly Haitian and Hispanic, revealed 25% who were familiar with the spiritual use of mercury, but were not users nor did they have users in their household. One patient reported using mercury by mixing it with her cologne and applying it daily 2 years before she gave birth to a child. Her urine and that of her newborn child were negative for mercury as were cord blood and amniotic fluid. However, her breast milk was reported to contain 57 µg/L of mercury (Wendroff AP. Study of mercury use in New York City. 1999.).

Although a significant number of studies have been completed, it is difficult to draw many solid conclusions from them. Data gathered to date are largely based on self-reports. Problems identifying willing participants result in small or non-representative samples, or both. Most data have been gathered in the New York metropolitan area. Not enough attention has been given to characterizing populations that use mercury and their underlying belief systems. Mercury use is often casually attributed to Santería, without evidence that it is more prevalent in that religion than in other spiritual or cultural traditions.

There are data gaps in our understanding of mercury use. A reliable estimate of the frequency of mercury use, as well as other toxic substances such as *precipitado rojo* (mercuric oxide), *greta* (lead oxide), and *azarcon* (lead tetroxide), is still needed. Knowing the details of the location, quantities, and frequency for each type of use, as well as its cultural origins will help to reliably estimate the distribution of different uses and resultant exposure levels. Still unknown is the extent of use across the population, including uses outside of Latino or Caribbean traditions (e.g., in Hindu, Wiccan/Neo-Pagan, or new age practices), and typical use patterns for individuals.

Little is known about how mercury is supplied to *botanicas* for retail sale. In December 1992, the California Department of Health Services received a consumer complaint filed by Dr. Arnold Wendroff of the Mercury Poisoning Project in Brooklyn, New York, that metallic mercury had been sold in several *botanicas* in the Los Angeles, California, area. This matter was referred to the U.S. Environmental Protection Agency's Office of Enforcement, which learned that Los Angeles area *botanicas*, as well as retail establishments in other areas of the country, obtained mercury from a metal recycler. EPA reported that this company sold a very small percentage (the exact numbers were not specified in the report) of its recovered mercury to religious supply companies throughout the country. These companies repackage and redistribute mercury, along with other religious articles, to small business establishments (e.g., religious stores and candle shops)[11]. However, less-formal operations, such as individuals in unmarked trucks delivering small amounts to *botanicas*, also seem to be in place[4].

1.4 Alternatives to Mercury

There are many possible alternatives to elemental mercury, depending on the religious or cultural tradition and on the desired outcome. It is not possible to say that elemental mercury can always be substituted by a particular substance, because mercury has so many different uses in so many different traditions. However, for any particular use, it is usually possible to find a way to achieve the same result with less-toxic materials, if a spiritual consultant in the appropriate tradition is asked for advice. For example, where mercury is used to speed the action of a spiritual work, *sangre de dragon* (dragon's blood, a red resin obtained from the fruit of several species of *daemonorops* palms) is considered in some traditions to be a very powerful substitute, but it is not considered toxic by scientists[12]. Amulets for personal protection can be made with *agua florida* (Florida water, a perfumed water or cologne), or by carrying any of a number of medallions or curios, such as the coin of the *siete potencias* (Seven African Powers). Purification or spiritual cleansing of a home can be accomplished with *agua florida*, or various plants.

1.5 Fate, Transport, and Exposure

Mercury's volatility and long residence time indoors create a potential for inhalation exposures to individuals. Mercury is difficult to remove from contaminated buildings, and small amounts can lead to contamination for extended periods of time.

Data gathered at mercury spill events provide some bounds for expected air concentration levels. Several months after a large jar of mercury was spilled in an Ohio apartment, two children developed acute mercury poisoning, and air levels in the apartment were 50 – 400 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$)[13]. In Michigan, a 300g spill resulted in air concentrations of 10 – 40 $\mu\text{g}/\text{m}^3$ several months after the spill and acute poisoning of three children in the house[14]. Breakage of a mercury thermometer on a vinyl floor, followed immediately by cleanup of all visible beads, resulted in mercury air concentrations of 5 $\mu\text{g}/\text{m}^3$ a week later, and 0 – 2 $\mu\text{g}/\text{m}^3$ 2 weeks later[15]. No similar incidents yet reported relate to cultural and religious uses of mercury. However, no one has looked systematically for these incidents, and socioeconomic and political barriers inhibit reporting (Engblom R, EPA Region 6. Personal Communication, May 23, 2001.).

A study at Montefiore Hospital in the Bronx[16]measured mercury in the urine of 100 pediatric patients (55% Hispanic, 43% African American), and showed a 3% rate of elevated ($> 10 \mu\text{g}/\text{L}$) mercury levels. This number is similar to the 4% rate of elevated blood lead levels in the same population, indicating that the mercury exposure may warrant similar public attention.

For any given overall household air concentration, children may be at higher risk for toxicity than adults. This is because mercury vapor is denser than air and becomes more concentrated near the floor where children do more breathing. Also, when compared to adults, pediatric respiratory air exchange per unit body weight (minute ventilation per kilogram) is greater; for the same air concentration of mercury, a larger dose in the pediatric population would be expected[17],[18].

The fate and transport of mercury vapor indoors are not well understood. For example, to estimate exposure from sprinkling mercury indoors, we need to predict typical droplet-size distributions. Droplet size determines the amount of surface area that is exposed to air, and along with temperature

and ventilation rates, the amount of mercury that volatilizes. Differences in exposure estimates of several orders of magnitude can occur for the same mass of mercury with different surface areas. Similarly, the effects of temperature, humidity, and deposition rates onto walls, floor, carpet, and other indoor materials are critical determinants of mercury levels that warrant further study.

Most important, there is a need for clinical data. Do people who use mercury for spiritual and folk tradition purposes (and people who share their living space) have elevated mercury levels? Ideally, clinical studies would follow up on findings of elevated urine levels with home testing and a source assessment. Because of the stigmatization of this practice and other political and cultural factors, it has been very difficult to find volunteers for this type of study. More realistic studies might simply determine whether members of Latino and Caribbean communities in U. S. cities have elevated mercury levels. A variety of factors could contribute to a higher mercury burden in these populations, so a study would not necessarily be able to conclude that cultural and spiritual uses were responsible if higher levels were found. However, if a pattern of elevated mercury levels is found, community groups will have a greater incentive to work toward identifying and reducing all mercury sources.

1.6 Environmental Monitoring

Actual measurements of mercury concentrations in indoor air in *botanicas* and residences are needed to gauge the severity of the problem, and to relate source and exposure data. Government agencies have set standards for mercury in indoor air to protect human health. EPA's risk database gives a reference concentration (RfC) of $0.3 \mu\text{g}/\text{m}^3$ of air[19]. ATSDR minimal risk level (MRL) for chronic or lifetime exposure is $0.2 \mu\text{g}/\text{m}^3$ [20](no intermediate exposure MRL has been developed). The reference concentration and MRL are not meant to be used as hard and fast rules for action; they represent conservative estimates of exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of adverse health effects during a lifetime. The Occupational Safety and Health Administration's (OSHA) ceiling limit (which shall not be exceeded at any time) is $100 \mu\text{g}/\text{m}^3$ [21], and the National Institute for Occupational Safety and Health (NIOSH) recommends an 8-hour time-weighted average (TWA) of $50 \mu\text{g}/\text{m}^3$ [22]in occupational settings. These standards were set in the early 1970s, and more recent 8-hour TWAs have been set by the American Council of Governmental Industrial Hygienists (ACGIH) in 1996 at $25 \mu\text{g}/\text{m}^3$ [23].

Methods for establishing mercury exposure measurements can vary at the state and local level, because equipment availability and cost considerations impact measurement protocol. Different technologies produce measurements with different levels of scientific uncertainty, which can affect decision-making about appropriate responses. Although the above standards guide decision makers, other site-specific variations are also considered, such as the time-activity patterns of building occupants, and the sensitivity of the population exposed.

The Jerome meter is a hand-held device that gives real-time readings of mercury in indoor air. An air sample passes through the instrument, and the electrical resistance of a gold film sensor inside increases in proportion to the concentration of mercury and mercury compounds in the air.

The Jerome is fast but loses accuracy at low levels (< about 10 µg/m³). It has a number of interferences that make its use in a cultural and religious exposure setting problematic. For example, the presence of smoke and nitrogen compounds, including ammonia, can create falsely high readings. Such compounds are likely to be present near an altar or in a *botanica* where candles are frequently lit and burned for hours.

The NIOSH 6009 method is recognized as a highly accurate measurement protocol for mercury in indoor air, but it requires lengthy sample times (8- hours standard), and the sample must be sent to a lab for analysis using atomic absorption spectrophotometry. Atomic absorption spectrophotometry can produce accurate readings at very low concentrations (certainly below the MRL of 0.2 µg/m³). Unfortunately, the NIOSH method is time-consuming, and it can be inconvenient for building occupants.

Thus, the Jerome is useful for exploratory readings and source identification, but the NIOSH method is often needed to determine what further actions might be necessary, and to verify cleanup levels. Typically, when using the Jerome meter, indoor air concentrations >10 µg/m³ can result in a decision to isolate residents from the exposure, and conduct an investigation to identify any sources of mercury in the home (appropriate response actions follow if necessary). For readings <10 µg/m³ that the Jerome still registers as non-zero (typically >3 µg/m³), further analysis (e.g., with the NIOSH method) is needed to get an accurate determination of mercury levels. In fact, further analysis may even be necessary with a non-detect on the Jerome, because of the instrument's level of sensitivity. Because cleanup goals may be set at or below 1.0 µg/m³, it is not possible to use the Jerome reliably for verification of cleanup.

Recently, a number of new hand-held instruments with greater sensitivity, were introduced into this complicated decision-making landscape. These instruments can provide accurate real-time readings <10 µg/m³ (some claim sensitivities as low as 0.002 µg/m³). The instruments use a form of atomic absorption spectrophotometry that isolates only mercury atoms for analysis.

This increased sensitivity may allow agencies responding to mercury spills to reduce the use of the NIOSH method and simplify their decision-making processes, in some cases. However, several considerations must be taken into account. First, it will be some time before these instruments have replaced Jeromes in the arsenals of state and local agencies, so it is necessary to continue to provide guidance to decision makers facing data based on the Jerome meter. Second, the instruments' accuracies must be more thoroughly tested against the NIOSH method to determine when and how they can be appropriately used. Third, time-weighted average measurements are still needed to estimate exposure properly and determine the risk levels for occupants. Although some of the new instruments have a logging capability that might be used to track measurements over time, the feasibility and accuracy of using an instrument in this way needs to be investigated further.

EPA scientists are gathering the necessary quality assurance/quality control data on these new instruments, while this equipment is being used on an experimental basis.

1.7 Comparison to Other Mercury Exposure Issues

It is important to understand the scope of this problem relative to other mercury issues. A 1999 EPA analysis of domestic mercury spills found that of 19 spill reports from 1986-1998, 11 (58%) were due to children playing with mercury, 3 were related to improper or former business practices on site, 3 were inadvertent (e.g., spills), and 2 were discoveries not related to residents' actions. The total cleanup cost for these incidents was \$6 million (range per incident was \$3,300 to \$3.4 million). No reported spills listed cultural and religious mercury use as a source of exposure[24].

ATSDR's Hazardous Substances Emergency Events Surveillance System tracks mercury releases in 16 participating states. An analysis of data from 1993-1998 shows that of 390 reported "fixed facility" (non-transportation) events involving mercury only, 65 (17%) occurred in private residences, 80 (21%) occurred in schools and universities, and 64 (16%) occurred in health care facilities. Causal factor data were available for 46 of the domestic events, with 33 stemming from human error, 6 from equipment failure (e.g., thermometers, gas pressure regulators, blood pressure devices), 4 from "deliberate" damage, and 3 due to other causes. Cultural and spiritual uses were not mentioned in any reported incidents. Thirty persons had elevated blood-mercury levels in four residential events – 24 were exposed in a single event, in which schoolchildren found mercury in an alley and brought it into several homes[25].

The mercury exposure that poses the greatest risk to most Americans is ingestion of methylmercury in certain kinds of fish. Hair and blood mercury data from the 1999 National Health and Nutrition Examination Survey (NHANES) indicate that approximately 10% of women have mercury levels within one-tenth of the reference dose (0.1 µg methylmercury/kg body weight/day) for methylmercury. A reference dose is an estimate (with uncertainty spanning perhaps an order of magnitude) of the daily exposure of the human population to a potential hazard that is likely to be without risk of deleterious effects during a lifetime. Virtually all of the mercury was organic, indicating methylmercury exposure as the primary source[26].

2. HEALTH EFFECTS

Recently, ATSDR was asked by the EPA to provide consultation about the health effects from inhalation of elemental mercury vapor in the home. This chapter summarizes the scientific literature related specifically to home inhalation exposures to elemental mercury vapor. It should be noted that in some aspects there may be overlap with toxicity from exposures to other forms of mercury (e.g., methylmercury or mercuric chloride) or other routes of exposure (e.g., ingestion). However, a distinction must be made between the adverse health effects from these other forms and routes of exposure and those due to elemental mercury vapor inhalation. It is easier to recognize toxicity from an acute exposure to elemental mercury in the home, than from chronic exposures because of non-specific signs and symptoms associated with the latter. Therefore, this document gives more attention to chronic exposures.

2.1 How Does Elemental Mercury Get Into The Home?

Elemental mercury can get into the home in a number of ways. Children may be exposed to mercury vapors when they bring metallic mercury home to play with it. The heavy, shiny, silver liquid that forms little balls or beads when spilled fascinates children. Children may find elemental mercury when they trespass in abandoned warehouses, closed factories, or hazardous waste sites. Children also have taken elemental mercury from school chemistry and physics laboratories and abandoned warehouses[18].

Broken thermometers, thermostats and other mercury-containing instruments or equipment (e.g., fluorescent light bulbs, barometers, blood pressure measurement equipment, and light switches) used in the home, and stored mercury, are other sources of metallic mercury[18],[27]. Workers in industries that use metallic mercury have inadvertently brought mercury into their homes on contaminated work clothing and shoes or boots, exposing household members to the chemical[28].

Sometimes persons are exposed to mercury when attempting to extract gold from gold ore by heating it with metallic mercury,[29],[30] or when heating amalgam dental fillings to extract the silver [14],[31]. This practice is especially dangerous because heating mercury increases tremendously the amount of toxic vapor released[18].

Mercury may also get into the home as the result of folk traditions and spiritual practices (see Chapter 1).

Metallic mercury and its vapors can remain for months or years on furniture, carpet, floors, walls, and other such items, thus continuing to be a source of exposure[18]. Elemental mercury contamination can be removed from some items, such as clothing, by exposing them to outdoor air and sunshine.

2.2 Acute, High-Dose Effects

In acute (short-term, on the order of hours), high-dose (concentrations on the order of 10 mg/m³, or 10,000 µg/m³) exposure, mercury first affects the respiratory system and can result in pneumonitis, severe bronchiolitis, pulmonary edema, and death[32]. In a number of case reports of fatal

inhalation toxicity from mercury vapor, all were attributed to respiratory failure[18]. Central nervous system effects, renal damage, and inflammation of oral tissue can also occur[32].

2.3 Chronic, Low-Dose Effects

With smaller doses (on the order of 10–100 $\mu\text{g}/\text{m}^3$) over a longer period of time (years) neurologic effects predominate[32]. These may include intention tremors, which initially affect the muscles of the eyelids, tongue, and fingers[33] and sometimes spread to other parts of the body. Often this tremor can be demonstrated when an individual attempts to draw or write[34],[35]. Other effects include emotional lability, which is characterized by irritability, excessive shyness, confidence loss, and nervousness; insomnia; memory loss; neuromuscular changes (e.g., weakness, muscle atrophy, muscle twitching); headache; ataxia; polyneuropathy (e.g., numbness, exaggerated tendon reflexes, and slowing of nerve conduction); and deterioration of performance in tests of cognitive function. In some cases, hearing or visual field loss or hallucinations have occurred[18]. Because of their variability and non-specificity, these chronic neurologic effects may be misdiagnosed as behavioral or psychiatric disorders[35],[36]. Other chronic effects include excessive perspiration or salivation, kidney dysfunction, and corneal or lens opacities. Occasionally, exposure to mercury causes a syndrome called acrodynia, or pink disease. Acrodynia is an idiosyncratic, non-allergic hypersensitivity response caused by an exposure to mercury. It can result in severe leg cramps; irritability; and abnormal redness of the skin, followed by peeling of the hands, nose, and soles of the feet. Itching, swelling, fever, fast heart rate, elevated blood pressure, excessive salivation or sweating, rashes, fretfulness, sleeplessness, or weakness, or any combination of symptoms, may also be present. Acrodynia has been thought of as a disease of small children, but has occasionally been reported in older persons[18],[32],[37],[38].

2.4 How Much Mercury Is Dangerous?

There are case reports of clinical findings, such as those listed in the previous section, associated with exposure to mercury vapors resulting from broken clinical thermometers (which contain about 0.3 mL, or 0.06 teaspoons, of mercury[27]) or blood pressure measuring devices[39],[40],[41]. Overall, the amount of mercury contained in a thermometer is small and does not present an immediate threat to human health. However, to avoid a health risk over time, the mercury should be cleaned up and disposed of properly.

2.5 Pediatric Effects

The long-term health effects in children with elevated urine mercury levels have not been well studied. However, for any given overall household air concentration, children may be at higher risk for toxicity than adults. This is because mercury is heavier than air and becomes more concentrated near the floor, where children breathe[42]. Also, when compared to adults, pediatric respiratory air exchange per unit body weight (minute ventilation per kilogram) is greater, so given the same air concentration of mercury, one would expect a larger dose in the pediatric population[17],[18].

2.6 Mercury in Breast Milk

There is evidence of inorganic mercury secretion in breast milk[18].

2.7 Reproductive Effects

Empirical data on reproductive risks of mercury exposure are limited. A number of studies failed to show adverse effects on fertility in male workers with urine mercury levels as high as 8,572 µg/L [17]. On the other hand, a few studies suggest that an increased risk of spontaneous abortion might be present when either the mother or the father have been exposed to elemental mercury resulting in urine values as low as 50 µg/L[18]. Although both methyl mercury and elemental mercury have been implicated as a toxicant effecting unborn children, data on the effects of elemental mercury are limited and mainly based on a few case reports. Although most of these case reports do not demonstrate adverse effects on the fetus, not enough evidence exists to conclude that the fetus is not vulnerable to such exposures [18],[30],[43],[44].

2.8 Genetic and Cancer Risks

The evidence is inconclusive as to whether there are risks of chromosome abnormalities secondary to inhalation exposure to elemental mercury. To date, epidemiologic studies have not documented an increased risk of cancer from exposure to metallic mercury[18].

2.9 Biological Monitoring

Measurement of mercury in the urine is the most widely accepted method of monitoring for toxic levels of exposure and most closely reflects the body burden of the substance[45],[46],[47],[48],[49],[50],[51],[52], especially in chronic exposures[53]. However, for a number of reasons, interpretation of urine mercury levels is not always straightforward. A bimodal pattern of excretion has been described with a rapid initial phase (half-life of 2 days), followed by a slower phase (half-life of 70 days)[54]. Inter-individual variation has been observed in the time it takes to rid the body of mercury. In volunteers exposed to 10 to 15 minutes of mercury vapor inhalation, for example, elimination followed a single-phased excretion pattern that varied from 35 to 90 days[55]. Also, urine mercury levels vary depending on what time of day they are collected (e.g., the level is highest in the morning[56],[57],[58]). Furthermore, the level of urine mercury at which an individual will manifest signs and symptoms of toxicity varies[59],[60],[61],[62]. Finally, urine levels may not adequately reflect mercury levels in the mammalian brain, and concentrations in various regions of the brain may differ[63],[64]. Although estimates of brain mercury half-life elimination rates in some studies of metallic mercury vapor exposure are as short as 21 days for a brief exposure, one case report found mercury persisting in brain tissue 10 years after cessation of known exposure[65].

Numerous studies have been conducted to ascertain how high the level of urine mercury accumulated must be before adverse health effects occur from chronic low-dose exposures. These studies focused primarily on the central nervous system, which is the target organ system most sensitive to this type of exposure. Effects on the kidney have also been reported, but generally at higher doses than those that result in neurologic toxicity[63].

These studies provided useful evidence linking chronic, low-dose mercury exposure to adverse health effects. However, they provide less guidance in interpreting what urinary mercury levels mean in any particular individual. Some papers report mean (or median) group values of urine mercury levels associated with renal and neurologic and neurobehavioral abnormalities without reporting the standard deviations[66],[67],[68],[69],[70],[71],[72],[73],[74],[75]. In others, the

lower 95% confidence interval calculated from the reported standard deviations are below zero, suggesting a non-normal distribution[76],[77],[78],[79]. When the distribution of urine mercury values does not correspond to a normal (bell-shaped) curve, it is hard to interpret what a person's urine level means with regard to health risk. Many of the reported standard deviations are large, indicating substantial inter-individual variations[77],[78],[79],[80],[81],[82]. No papers could be found that reported the sensitivity (i.e., the probability of the test being positive if disease is present), specificity (i.e., the probability of a test being negative if disease is absent), predictive value positive (i.e., the probability of disease if the test is abnormal), or predictive value negative (i.e., the probability of being disease-free if the test is normal) of urine mercury tests in an individual[83]. Knowledge of these probabilities is necessary if the urine mercury level is going to be of any practical value in guiding health care interventions in any given individual patient.

Some guidance is provided to the clinician by data collected on urine mercury levels in reportedly unexposed subjects. Goldwater reported urine mercury levels from 1,107 participants in a non-randomized multinational sample of persons without a known history of mercury exposure[84]. He found that urine mercury levels as follows:

- <0.5 µg/L in 78%
- <5 µg/L in 86%
- <10 µg/L in 89%
- < 15 µg/L in 94%
- <20 µg/L in 95%
- <25 µg/L in 96%
- 25 – 50 µg/L in 1.9% and
- >50 µg/L in 1.5%

The highest urine mercury level found was 221 µg/L.

The author points out that the study used convenience sampling, and participants were not picked randomly. The currently accepted upper normal value for urine mercury is based on the level found in 95% of the unexposed population, i.e., 20 µg/L[85]. Although a number of studies have found adverse neurotoxic effects at higher urinary mercury levels[59],[66, 67, 68, 69, 70, 71, 72, 73],[86],[87],[88]the lowest mean chronic urinary mercury levels at which adverse health effects have been demonstrated in humans are close to the upper background value of 20 µg/L. Many of these studies reported on very subtle signs of toxicity that required sophisticated instrumentation to detect and which would not generally show up on a clinical neurologic exam. Piikivi and Hanninen[81]studied workers exposed to mercury who had mean urine levels of 10.1 µmol/mol (standard deviation (SD) 6.8, range 1.9 – 31.2) and controls with mean levels of 1.2 (SD 0.9, range <0.6 – 3.8). These values correspond to 17.9 µg/g (SD 12.0, range 3.4 – 55.2) and 2.1 µg/g (SD 1.6, range <1.1 – 6.7)[42]. Exposed workers showed significantly more sleep problems and higher mood scale values for anger, fatigue, and confusion compared with controls. No significant decrements in psychomotor tests or memory and learning were found in exposed persons. Echeverria et al.[77]studied exposed dentists with spot urine mercury levels >19 µg/L (compared with unexposed controls having no detectable mercury in urine) and found decrements in tests of neurobehavioral function. The mean urine

mercury level in the exposed group was 36 µg/L, but with a large SD of 20 µg/L. Fawer et al. [89] found increased hand tremor in exposed subjects with a mean urine mercury level of 11.3 µmol/mol creatinine and SD of 1.2 µmol/mol. This corresponds to a mean and SD of 20 µg/g creatinine and 2.1 µg/g, respectively[42]. Chapman et al. found changes in tremor in exposed workers with mean levels of 23.1 µg/L (SD of 28.3 µg/L)[78].

Several studies have been published on adverse renal effects as they relate to urinary mercury levels, and these effects seem to occur at higher mercury levels than those that cause neurobehavioral effects. Naleway et al. studied dentists with urine mercury levels of 0 – 115 µg/g creatinine and found no relationship between the mercury levels and serum creatinine, creatinine clearance, serum β -2-microglobulin (B2M), or urine B2M[75]. Boogaard et al. compared high exposure (mean 23.7 µg/g creatinine, range 3.5 – 71.9), low exposure (mean 4.1 µg/g, range 0.6 – 8.8), and non-exposed controls (mean 2.4 µg/g, range 0.5 – 6.8)[74]. No standard deviations were reported. Although B2M and N-acetyl- β -D-glucosaminidase were higher in the groups with high exposure when compared with the low-exposure groups, both were within the 95% confidence interval of the levels found in the unexposed control groups. Buchet et al. did not find an increase in urinary albumin, transferrin, orosomucoid, B2M, alkaline phosphatase, or plasma creatinine in those persons with mercury levels <50 µg/g[81]. The authors also reported an increase in β -galactosidase in those with urine mercury levels of 5 – 49.9 µg/g, but the authors also indicated that the health consequences of this finding were unknown. Roels et al. reported that increased excretion of urinary proteins was seen at a mean urinary mercury level of 95.5 µg/g (range 9.9 – 286.0, 5% level of 12.3, 95% level of 245.4)[69]. However, urine levels of amino acids, B2M, retinol binding protein, and albumin were not significantly elevated compared with controls.

A number of papers have reported on urine mercury levels at which neurologic symptoms are more likely to be found on a routine neurologic examination. Some found that symptoms and signs were not apparent in the patient's medical history or on the physical exam until urine mercury levels were in the 50 – 100 µg/L or µg/g creatinine range[18],[90],[91]. In other studies, this occurred at 102 – 162 µg/L or µg/g[47],[92],[93],[94] 200 – 450 µg/L or µg/g[95],[43],[59],[71],[72],[93],[95] or even as high as about 1,000 µg/L[90],[96].

2.10 Treatment

The comments of Campbell et al., epitomize the dilemmas faced by clinicians treating patients exposed to elemental mercury[97]. Although case studies might applaud specific treatment modalities, there is a paucity of empirical data on how these treatment alternatives affect outcome. The result is an absence of evidence-based treatment decision guidelines. In particular, there is little to help the physician identify patients with a good prognosis who may avoid unnecessary therapy.

Chelation has been touted not only as a treatment[98],[99],[100], but as method of diagnosis as well [101],[102],[103],[104]. The safety and efficacy of chelation for diagnostic purposes is unproven [105],[106]. Some authors have reported the recommendation that all individuals who have specified blood or urine mercury levels or who are symptomatic should undergo chelation[90],[98]. Unfortunately, little empirical evidence exists to justify these blood or urine levels as an indicator for chelation. Furthermore, many of the clinical signs and symptoms of mercury toxicity are

nonspecific (e.g., forgetfulness, headache, irritability, emotional lability, insomnia, inability to concentrate, nervousness, anxiety, dizziness, nightmares, excessive shyness, violent behavior, decreased appetite, weight loss)[85],[107],[108]. These findings may overlap with signs and symptoms due to nontoxic psychiatric disorders, thus leading to a misdiagnosis[36],[97],[109]. The rarity of mercury toxicity[94] may also make it less likely to be high on the list of conditions a clinician would typically consider. Intention tremor is probably one of the least ambiguous findings related to metallic mercury exposure[108]. Although some authors recommend monitoring urine mercury levels to assess the efficacy of chelation, the urine levels that should guide the initiation or cessation of treatment are not clearly documented[98].

There are few controlled, systematically collected data on how chelation affects the outcome of elemental mercury toxicity. The results from the case-study design reports completed are hard to interpret [29],[94],[97],[110],[111],[112],[113],[114],[115],[116],[117]. A number of investigators have noted increased urinary excretion of mercury after the administration of chelators [31],[85],[90],[104],[106],[111],[116],[118],[119],[120],[121],[122]. However, evidence is lacking to show that the outcome is better for those who are chelated versus those merely removed from exposure [34],[35],[36],[85],[91],[101],[102],[122],[123],[124],[125]. It is possible that this occurs because chelation mobilizes only a small proportion of the total body burden of mercury or because it mobilizes mercury in the kidney tissue, but not in the brain[126]. Because some cases of mercury toxicity will abate with simple removal from exposure,[33],[107],[127]it is difficult to assess the effects of chelation therapy without doing controlled studies. In a review article, Kosnett was only able to find one study that addressed this issue[128]. This study involved 86 patients treated with the chelator, dimercaprol (BAL) within 4 hours of ingesting >1g of mercuric chloride. Although the study showed improved survival when compared to historic controls, its relevance to patients with longer term exposure to elemental mercury is unclear.

Some have expressed concern that chelators, by mobilizing mercury from other tissue stores, may enhance brain levels and worsen toxicity[37],[101],[129]. The potential for adverse consequences when chelation therapy is used is an issue in treatment decisions. For example, approximately 50% of patients treated with BAL experience adverse drug reactions. Doses >5 mg/kg may result in vomiting, seizures, stupor, and coma[103].

3. HISTORY OF ACTION AT FEDERAL, STATE, AND LOCAL AGENCIES

3.1 EPA

EPA first took up this issue in 1992, when the California Department of Health and Human Services investigated a complaint, lodged by Dr. Wendroff, related to the sale of elemental mercury in folk pharmacies or *botanicas* in the Los Angeles area. The EPA's Office of Enforcement took up the matter for consideration under section 7 of the Toxic Substances Control Act (TSCA)[130]. In January 1993, the Office of Pollution Prevention and Toxics (OPPT) conducted a risk assessment to determine whether these uses of mercury constituted an "imminent hazard to human health."

OPPT noted that "many uncertainties still exist regarding the extent and conditions of use of mercury in these practices" but offered two scenarios as "bounding estimates" of exposure. Acute exposures were found to be of low to moderate concern, but chronic exposures were found to be of high concern. Three risk-management options were considered: risk communication in a public outreach campaign, product stewardship to prevent distribution of mercury to *botanicas*, and regulatory action under TSCA. Product stewardship was deemed ineffective because there are many legal sources of mercury; regulatory action was deemed resource-intensive, difficult to implement and enforce, and a potential infringement of religious freedoms protected by the First Amendment[11].

EPA engaged several national Latino organizations for help implementing a public outreach strategy. The organizations had the following suggestions[11]:

- EPA should carefully identify the target population because mercury use is more likely to be limited to specific communities and not likely to be widespread.
- A risk communication program should be established, with the help of Latino organizations; the program should be framed as general mercury education with no mention of religion.
- Other interventions such as preventing suppliers' sales of mercury to *botanicas* would likely be ineffective, drive the problem underground, and erode the already low level of trust the community has in government agencies.
- EPA should have an ongoing dialogue on other environmental and public health problems of concern to Latinos, including pesticide exposures to farm workers, environmental justice analysis of Toxic Release Inventory (TRI) data, and cross-border disposal problems along the Rio Grande.

In September 1994, the EPA launched an informational campaign, including a two-page mercury alert and a four-page technical fact sheet to be used as a resource for other groups contacted about mercury uses. The fact sheet was produced in English, Spanish, and Portuguese (Appendix A). EPA sent outreach materials developed by California and Connecticut (Appendix A) to state Departments of Health and Environment, flagging this issue for them. States were asked to provide EPA with both the names of community groups who could help in getting the message out, and a list of contacts who could provide assistance with health or clean-up issues.

As part of this outreach effort, EPA developed and aired a series of radio broadcasts on the subject. Broadcasts were written, translated and recorded by the Hispanic Radio Network, Inc. as part of a

regularly scheduled daily program called “The Best of All Worlds,” which dealt with environmental and health issues. The broadcasts consisted of five segments that discussed the uses of mercury, potential substitutes, dangers to health, diagnosis and treatment, and cleanup of contaminated homes. The segments aired on five consecutive days in September 1994 on all the Spanish language stations that are members of the Hispanic Radio Network across the United States. Segments were prepared and delivered by the show’s host, Reverie de Escobedo.

In addition to the outreach effort, the Chemical Control Division in the Office of Prevention Pesticides and Toxic Substances sent a letter to mercury producers, importers, and recyclers, informing them of the hazards involved in downstream uses of mercury and encouraging them to implement product stewardship measures to ensure that labeling and other safety information distributed with their products are supplied to downstream users. In particular, recipients of the letter were asked to work with mercury distributors to ensure that they are taking appropriate steps to ensure that consumers are made aware of the hazards of mercury.

In response to several poisoning incidents involving school students in 1994, EPA’s Office of Emergency and Remedial Response (OERR) developed and distributed a pamphlet and video directed toward children about the dangers of playing with mercury (Appendix A).

In 1997, EPA issued a joint alert with ATSDR about continuing patterns of mercury exposure, reporting several incidents from 1994–1997 involving mercury poisoning in schoolchildren, and warning of the potential for similar incidents occurring from spiritual and folk traditional uses, although no such incidents had been reported. The alert was released in English, Spanish and Haitian Creole[131]. This was part of an agency-wide mercury outreach strategy, that included a conference on pollution prevention, use reduction and disposal, an outreach project to science teachers nationally, and a mercury spill fact sheet, as well as an intra-agency task force that developed an EPA Action Plan for mercury.

In November 1998, Dr. Wendroff contacted the Community Involvement and Outreach Center (CIOCC) in EPA’s OERR with a concern about what he believed to be a large number of contaminated homes soon to be discovered. Because of the potential for releases to the environment, the issue was taken up by OERR to review the extent and severity of the problem. After conducting initial background research and identifying previous work done by states and OPPT, a multi-agency task force was established to assess the problem. The Task Force included representatives from EPA; ATSDR; Consumer Product Safety Commission (CPSC); and state, county, and city health departments. Private citizens representing academia and community groups were also invited to join. Task Force conference calls began in January 1999.

In 1998, EPA Region 5 gave approximately \$20,000 in a grant to both the Illinois State Health Department and the Chicago Health Department, to obtain measurements of mercury levels in residences where spiritual and folk traditional practices occur. Because access to homes has proven exceedingly difficult to obtain, this research is ongoing. EPA Region 2 similarly gave a \$20,000 Environmental Justice grant to the Puerto Rican Family Institute (PRFI) (originally in conjunction with Dr. Wendroff) to gather information from community members in New York City

about the use of mercury for spiritual practices. A short questionnaire was developed and given to subjects who visited PRFI; there was a low reported familiarity with mercury use in religious practices. PRFI also developed pamphlets in English and Spanish (Appendix A) addressing elemental mercury poisoning from spiritual uses. A 1998 Environmental Justice/Pollution Prevention Grant was awarded by EPA Region 2 for more than \$82,000 to Clyde Johnson (principal investigator [PI]) and Arnold Wendroff (co-PI), to investigate mercury sales in Brooklyn, and to obtain residential measurements of mercury vapor concentrations.

3.2 ATSDR

ATSDR and EPA issued a joint alert in 1997 on “continuing patterns of metallic mercury exposure,” including incidents involving (a) schoolchildren who were exposed to high levels of mercury at school and elsewhere, and (b) religious uses of mercury[131].

In 1999, ATSDR prepared a draft framework for “public health response to ritualistic use of elemental mercury”[132]. A four-part framework was proposed, consisting of outreach, education, environmental and clinical response, and capacity building for partnerships with state, district, and local health departments. Many of that report’s recommendations have been discussed by the Task Force and are incorporated here.

3.3 Consumer Product Safety Commission

The CPSC is empowered to oversee the labeling of hazardous substances in consumer products under the Federal Hazardous Substances Act (FHSA)[133]. A label similar to the following is required for mercury, in addition to information identifying the name and location of the manufacturer:

Front: WARNING: VAPOR HARMFUL. HARMFUL IF SWALLOWED. See additional cautions on (side/back) panel.

Side/Back: Contains mercury. Mercury vapors are toxic. Do not apply heat to the mercury. Avoid opening or spilling it. If spills occur, push the mercury onto paper, put it in a closed container, and discard it in the trash. DO NOT sweep or vacuum. Do not burn the mercury or throw it down the drain. Wash hands thoroughly after handling. If swallowed, DO NOT INDUCE VOMITING. Immediately call a physician or Poison Control Center for first aid instructions. Keep out of the reach of children[134].

Even if properly labeled, the sale of mercury for household use is not recommended by the CPSC.

The CPSC has overseen compliance with mercury labeling requirements. It has issued Consumer Safety Alerts[135] and distributed them specifically among populations of potential mercury users. It has warned large suppliers that mercury may not be distributed for resale to consumers unless properly labeled, and provided a sample warning label to pass on to any retailers who may purchase mercury from them for resale.

The CPSC also acted with the cooperation of a distributor in a 1995 voluntary recall of mercury necklaces imported from Mexico, which consisted of a small glass ball or vial filled with mercury on a leather or beaded chain[136].

3.4 California

The California Department of Health Services issued a public warning about the personal use of mercury in January 1994, after the Los Angeles County Department of Health Services investigated the sale of mercury in the Los Angeles area[137].

3.5 New York State

New York State Department of Public Health conducted a study in the mid 1990s of mercury in Chinese folk medicines, in which laboratory analysis revealed high concentrations of mercury, arsenic, and lead in certain medicinal products. Some medicines, if administered at the recommended doses, could result in doses of mercury that exceeded those associated with nervous system effects in humans. The Food and Drug Administration was contacted about these medicines in 1996[138].

3.6 New York City

New York City Health Department of Health and Mental Hygiene has been responding to mercury uses in religious and folk practices since 1991, including outreach with fact sheets, brochures, posters and press releases, as well as working with *botanica* owners in all five boroughs. The department developed and distributed a clinician's brochure to 4,000 licensed New York City pediatricians, family practitioners, and obstetricians/gynecologists; they also developed and distributed a general brochure to *botanicas* for the public in English, Spanish, and Haitian Creole. The department subsequently sent a letter to *botanicas* for which addresses were available, explaining the labeling requirements for mercury, and inspectors conducted follow-up visits. This activity may have caused mercury sales to go underground in New York and northern New Jersey[4], (Redmond P. U.S. Environmental Protection Agency. Personal communication with Eric Canales, New York Academy of Medicine, February 15, 2001.).

Early results from the follow-up visits included some air measurements taken with a Jerome instrument. No measurements taken inside the *botanicas* exceeded any occupational exposure limits (the highest was 20 – 22 $\mu\text{g}/\text{m}^3$). However, these levels would be of serious concern if a *botanica* were in a multi-use space that someone used as a residence, in addition to (or adjoining) a commercial space. Due to these concerns 11 *botanicas* that were identified during the initial surveys as sharing the building with a residence were sampled. A Lumex RA-915 was the instrument used for all of these inspections. Five of the 11 *botanicas* sampled evinced levels above 1 $\mu\text{g}/\text{m}^3$ in a breathing zone (range 1 – 8 $\mu\text{g}/\text{m}^3$). As a result of these findings, residential common areas and or apartments, and in one case a business, were sampled in each instance. None of samples collected in these residential areas, including samples collected outside of occupant breathing zones, e.g., riser penetrations at floor level) exceeded 1 $\mu\text{g}/\text{m}^3$.

3.7 Connecticut

The Connecticut Department of Public Health conducted a study[12]described elsewhere in this report in collaboration with the Hispanic Health Council. The state's implementation plan to address cultural and religious mercury use provided for the distribution of bilingual/bicultural materials

where *azogue* is sold, including in *botanicas* and working sites of folk medical practitioners. A comprehensive brochure (Appendix A) was developed by the Hispanic Health Council, and published and distributed for outreach in 1993, with one version for medical professionals and mercury suppliers and another for the general public. Commercial establishments selling mercury were asked to provide an educational brochure to each mercury customer, as well as display a visible poster describing the health hazards of *azogue*. The biggest challenges Connecticut encountered were limited resources and community resistance.

Additionally, information on mercury was distributed at thermometer points of purchase, and a series of radio interviews on Spanish language stations were aired. Press releases were designed, and stories were carried in several Spanish language newspapers as well as on the front page of the *Hartford Courant* (Toal B. Connecticut Department of Health. Personal communication, August 2, 2001.).

Connecticut is updating its fact sheet and reinvigorating its efforts for community education, including a plan to branch out to other cities in Connecticut with Latino populations (e.g., Bridgeport, Waterbury, New Haven).

3.8 Chicago/Illinois

The findings of the Chicago Department of Public Health's 1997 study[3] are described elsewhere in this document. The Illinois Department of Health, Division of Environmental Health was given EPA funding in 1998 to determine mercury levels in air as a result of cultural and religious mercury use, to determine which uses result in the greatest exposures, and to determine whether cultural and religious uses of mercury constitute a public health hazard.

Both agencies are hopeful that mercury use has decreased, as a September investigation by the *Chicago Sun Times* found only 1 of 15 *botanicas* reported continuing sales of mercury[5]. However, it is possible that the reporter could not gain access to mercury because the sales have simply gone underground.

3.9 Oregon

In April 2001, the Oregon Department of Human Services, Health Division issued a health alert about mercury necklaces imported from Mexico and worn by children in schools. The necklaces have mercury and sometimes a brightly colored liquid contained in a hollow glass pendant on a leather cord or beaded chain. Pendants come in shapes including hearts, bottles, chili peppers, and saber teeth. When school students bring them into the classroom, they can break, causing spills [139].

The alert provided information about the necklaces and their risks, the health effects of mercury vapor, and information on spill prevention and response in schools. The alert was distributed via the World Wide Web and submitted to the Oregon Department of Education for distribution to schools.

3.10 Puerto Rico

Under a 1973 Puerto Rican law amended in 1987, hazardous products may not be sold to the public without written labels, and the sale of certain hazardous substances is prohibited altogether. On January 15, 1991, in response to a complaint from Dr. Wendroff, an inspector from the Department of Health in Puerto Rico visited a *botanica* and purchased mercury. In a May 1991 order, the sale of mercury in *botanicas* was found to constitute a danger to the consumer and to the community, in violation of the hazardous substances law. The Mardo Distributing Corporation, which was a mercury supplier to industries in Puerto Rico and the Virgin Islands, was prohibited from packaging mercury in small vials for sale to consumers[140].

4. SUMMARY OF TASK FORCE ACTIVITIES

4.1 Plenary Conference Calls

Task force members participated in regular plenary conference calls (Appendix C). The group organized itself into three subcommittees, which held additional calls to conduct their business regarding clinical research, environmental monitoring, and community outreach. Plenary calls served as a forum for sharing information, discussing the results of subcommittee work, and raising for consideration a wide range of policy options for addressing this issue (Chapter 5).

The Task Force decided to host a forum as a vehicle to hear from experts on this issue. Because many of the researchers involved with cultural and religious mercury use had been active task force participants, and had already shared much of their knowledge with the task force, it was decided that the most beneficial use of the time at the forum would be to focus more narrowly on listening to religious practitioner and community outreach experts.

4.2 Activities of the Clinical Research Subcommittee

The clinical research subcommittee reviewed the literature on elemental mercury exposure and health effects, shared information about ongoing research, and identified research needs. This work is reported in Chapters 1 and 2, and Sections 5.2 and 6.2.

4.3 Activities of the Environmental Monitoring Subcommittee

The Environmental Monitoring Subcommittee discussed available measurement technologies for elemental mercury in indoor air, and typical action levels used in different situations by regulatory agencies. The subcommittee reviewed sample protocols for the investigation and response of mercury spills. The work of the committee is reported in Sections 1.5 and 6.3.

4.4 Activities of the Community Outreach Subcommittee

The Community Outreach Subcommittee shared information about ongoing outreach activities and resources (Appendix A has sample resources), barriers to community involvement, and strategies for involving the community in outreach efforts. Much of this information can be found throughout this report, especially in Chapter 3 and Sections 5.1 and 6.1.

To receive input directly from community members on outreach strategies, representatives of the task force began a series of interviews in fall 2000 with community, religious, and public health leaders in the Washington metropolitan area. The persons interviewed were representative of communities that may be exposed to mercury through a number of routes, including through religious ceremonies and practices.

The task force requested interviews from 19 individuals and/or organizations that work extensively with communities of Latin and Caribbean origin. Of these, a total of six interviews were granted and conducted by members of the task force (Appendix D). Through these interviews, the task force hoped to gain a better understanding of the ways in which mercury is used, the cultural sensitivities surrounding such practices, and opportunities to reduce risks and exposures in the community from all home sources of mercury exposure.

Those persons interviewed were asked a series of questions, depending on their organization's purpose. The interviewees were educated on the activities of the task force as well as its mission in conducting the interviews. After each interview, interviewees were asked to participate in the task force forum in May 2001. Although not all were available to attend, each interviewee shared with task force representatives salient points that should be addressed in such a forum. The complete results and recommended actions from each interview are presented in Appendix D.

The salient points gathered from the interviews are summarized below:

- Overall, there is a lack of information regarding the impact of mercury's use in communities.
- The majority of organizations interviewed had limited involvement with this issue and were unaware of any reported incidents of cultural and spiritual mercury exposures. Most had little if any direct experience with spiritual and folk traditions that incorporate mercury use.
- Most reported that mercury use is not widespread throughout Latino and Caribbean communities. Some suggested that it may be much easier to obtain mercury in the United States than in home countries.
- It is believed that most consumers from these communities are unaware of mercury's adverse health effects.
- In some traditions, the physical nature of the metal is believed to enhance a spell's effectiveness.
- The regulation of mercury would not necessarily cease the supply and demand, but just intensify this issue by causing the sale of mercury to go underground.
- Embracing the broader issue of mercury exposure as a whole is the most effective means for educating the public.
- All organizations interviewed expressed a willingness to assist the task force in either data acquisition or education and outreach efforts.

Respondents offered the following suggestions for addressing the problem:

- Focus outreach more broadly than just on Latino and Caribbean communities who engage in cultural or religious practices; a more general approach will be better received and reach a wider audience.
- Capitalize on previous experience with HIV/AIDS education when developing potential education and outreach strategies; previous experience, may be useful in surmounting barriers associated with cultural taboos and a reluctance to speak about private or personal practices.
- Examine all domestic routes of exposure involving mercury and plan a "best approach" for addressing them.
- Gather clinical data from experimental and hospital studies regarding exposure levels of mercury and its effects.
- Conduct a wide reaching campaign that encompasses the hazards of mercury in general by developing educational videos and national publications in Spanish.
- Seek expertise of anthropologists familiar with cultural practices affecting health care.
- Engage religious leaders that represent many area religions in outreach and education; lay persons may be more inclined to heed warnings of the hazards associated with cultural and religious mercury use if it comes from a trusted community figure.

4.5 Forum on Ritualistic Uses of Mercury

The Forum on Ritualistic Uses of Mercury was held May 14 -15, 2001, in Arlington, Virginia. The task force convened the discussion forum to understand better the cultural and religious components of this environmental and public health issue. Approximately 40 people participated in the forum, including cultural and religious practitioners; environmental, public health, and community advocates; government officials; and academicians.

4.5.1 Desired Outcomes

Three desired outcomes for the forum, guided the planning and structure for the 1.5 day event:

- **Task force members and other forum participants will understand the origins, scope, and complexities associated with cultural and religious uses of mercury.** A panel of four faith practitioners was invited to the forum to provide insight into the beliefs and practices of their respective traditions, and to educate participants about how mercury is and is not used within that tradition.
- **Participants will help develop outreach strategies that incorporate the perspectives of community members and health educators who work effectively with Latino and Caribbean communities.** A panel of community health education experts was assembled to provide best practices and lessons learned for conducting cross-cultural outreach and education, and to help develop innovative means for building support from a variety of community organizations and institutions.
- **Participants will provide input to the task force activities report.** A draft form of this report was distributed to participants before the forum, and participants were asked to comment on the entire report. Break-out sessions were designed specifically to discuss and revise report recommendations (Chapter 6).

4.5.2 Participant Expectations

The expectations of forum participants were also solicited before the meeting, to plan a more productive event and to assist in evaluation of the forum on its conclusion. The three main themes culled from the responses were:

- **Listen and understand** – particularly regarding the context, meaning, and specific practices of cultural and religious mercury use.
- **Network** – connect with others involved in reducing mercury exposures in communities, and forge ties that would help participants work together productively in the future.
- **Action** – setting a clear direction for research, and actively involving community members in risk assessment, outreach, and education.

4.5.3 Facilitation and Evaluation

In an effort to ensure all voices were heard and the stated objectives were met, a skilled facilitator experienced in cross-cultural issues moderated the forum proceedings, assisted by a team of

facilitators who moderated the break-out sessions. The end-of-forum evaluations indicated that expectations were met and the vast majority of participants felt it was a success.

4.5.4 Panel 1: Religious Practitioners

In the first panel, representatives from Santería, Palo Mayombe, and Voodoo shared their experiences and beliefs with forum participants, providing background on their faith tradition and the ways that mercury is and is not incorporated into its practices. Major points that emerged from the first panel session include the following:

1. **The community is diverse.** Numerous faiths within faiths exist in Latino and Caribbean communities. Knowledge of and involvement in specific religious practices vary from region to region. In some cases, mercury is central to religious belief or practice; in other cases it has a more general cultural context. Mercury is used in a variety of manners and contexts, posing different levels of risk to the user.
2. **It is important to get the real story.** Many African diaspora religions have been misrepresented and endured a great deal of persecution. Academia alone does not present a complete and accurate picture, nor do many popular mass-market books; ordained practitioners, recognized elders, and other community figures are untapped sources of information on cultural uses of mercury.
3. **Mercury is available.** Mercury is easily obtained and readily available to those who wish to use it, and most of the people who buy mercury for cultural and religious purposes are recent immigrants to the United States. Much of its sale and distribution is unregulated and operates underground.
4. **Put mercury use in context.** The lack of access to the modern American health care system in many minority and immigrant communities has prompted many to employ traditional folk remedies, some of which include mercury. For these users, mercury is often used repetitively until the underlying problem is resolved. Many of those who use mercury are not aware of its toxicity, or that breathing the vapors creates the highest exposures.
5. **Tips for education and outreach.** Education should be focused across the board to a wide range of cultural and religious groups. Focusing on only a few traditions will be counterproductive. Other religions, such as Hinduism, also use mercury, but are largely overlooked in research, education, and outreach efforts. Providing people with information will result in behavioral changes that reduce exposure. Alternatives to mercury exist, and it is important to be sure they are in fact safer than mercury.

4.5.5 Panel 2: Health Educators

The second panel was comprised of Latino and Caribbean health educators and other health educators who serve Latino and Caribbean populations. Major points that emerged include the following:

1. **Use peer education with people who will be respected by the community.** Some community members might be suspicious of outsiders. Peers and respected religious leaders in the

community will be best received, but sometimes community and religious leaders will be reluctant to get involved if they stand to lose the trust of their community

2. **Use effective ways of reaching people**, including frequenting local businesses such as beauty salons and laundromats; hosting events with free food and an educational program; and using Spanish language print, radio, and television avenues. Get to know the community so you can include local businesses and community organizations. Be aware of political issues among community groups to ensure that working with one group will not hinder your relationship with another.
3. **Put the issue in the proper perspective.** A number of pressing health issues in Latino and Caribbean communities require attention. When resources have to be allotted to so many other health issues, it is important to put cultural and religious mercury use in proper perspective.
4. **Determine what needs to be followed through.** Be sure you have a plan for referring people in need of further medical attention, and that culturally sensitive and multilingual staff are available to handle inquiries, including addressing health insurance issues.
5. **Know your audience.** Focus groups are an effective way to involve the audience population and identify the most effective messages. Messages must be clear and practical. Try to understand mercury use from the user's perspective; they are rational decision makers, and mercury use makes sense based on their information and context. Materials must reflect knowledge of the audience in format, design, and literacy level. Using language that indicates appropriate cultural context (for example, Lukumi words when discussing Santería) is helpful.

Summaries from the panel sessions are provided in Appendix B.

4.5.6 Breakout Sessions

Breakout sessions focused on report recommendations (Chapter 6) and on conducting community outreach and education activities. The following ideas emerged as suggestions for local health departments and community-based organizations engaged in planning outreach programs.

1. Know Your Audience

a. Focus groups are not only necessary for outreach, they are fundamental. However, it is difficult to recruit participants for such a sensitive topic. Money is a possible incentive to attract participants; assure them that the discussion will remain general. Another suggestion is to have an involved person (possibly a practitioner) lead the focus groups. Focus groups should be conducted for practitioners, sales people, and lay people as well.

i. Research should be conducted to better know the audience. Depending on available funding, this could include focus groups and marketing research.

b. Some suggestions from forum participants for reaching the audience:

i. Provide information in a sensitive manner. To be effective programs must present information to the targeted audience in a sensitive manner.

- ii. **It is unrealistic to expect an immediate cessation of mercury sales or usage.** Successfully educating the community and subsequently reducing mercury exposures will be predicated on a cultural transformation that will not occur overnight.
- iii. **Remember that there are conflicting messages about the safety of mercury.** Mercury is still used in school laboratories, dental work, and thermometers. Such use fosters the perception that mercury is a benign substance.

2. Follow through

- a. A long-term support network will be needed to handle referrals and inquiries resulting from the educational outreach. The support network may include a hotline, perhaps at the state level, that is manned by individuals who are multilingual and culturally sensitive. The support network should also include a plan for referring individuals to health care providers that will receive them regardless of immigration status, insurance coverage, or income.

3. Evaluate!

- a. All groups undertaking outreach activities should evaluate the effectiveness of the outreach effort, which is critical to measuring success and determining future directions for educational efforts. Quantitative and qualitative evaluation methods will measure process, outcomes and impacts, including changes in awareness, knowledge, attitudes, and behaviors (Appendix E).

Specific Recommendations for different Outreach channels:

1. Media

- **The right media outlet needs to be targeted for specific cultures.** Research should be done on which communication medium will penetrate the target community (radio, television, or newspaper). It was suggested that radio programs are popular within minority communities.
- **Identify media channels to target local communities.** Local TV, radio, and newspapers that target specific communities should be used where possible. Mainstream media may also be used to reach community youth.
- **Develop/use posters and brochures to get the message out.** Train, subway, and bus stations were suggested as appropriate areas for placing posters in targeted community areas. Ensure that materials developed target the community that should be reached and the materials are interesting and colorful.
- **Use public service announcement videos to target specific audiences.** There was general consensus that developing public service announcement (PSA) video tapes explaining what mercury is and its resulting health effects would be an effective

means of getting the word out on mercury. Such spots are run in health clinic waiting rooms and on closed circuit hospital channels.

- **Use radio/television spots.** Television and radio spots were suggested as a good means of reaching less disfranchised groups. Showing informational spots during prime viewing hours, such as during soap operas, was noted to be particularly effective.

2. Social Networks

- **Take advantage of mandatory meetings between community-based organizations and other large associations with similar programs.** Many community-based organizations take part in mandatory meetings with other organizations/associations with similar goals (e.g., state and local health departments). Participants suggested that community-based organizations take advantage of the captive audience at these events to share information and network on mercury exposure issues.
- **Provide free breakfast/lunch programs to gather community members for informational meetings.** The National Alliance for Hispanic Health (NAHH) has found such programs to be successful in bringing in a targeted group, such as mothers with children in the Headstart program, to provide them information on a given topic.
- **Expand the pilot “Amnesty Day” in Florida that provides for safe disposal of household mercury.** “Amnesty Day” is a pilot program sponsored by the state of Florida in which the state disposes of mercury in households at no cost.
- **Distribute educational materials in centrally located community businesses.** Beauty parlors, laundromats, legal aid societies, hospital community centers, and food distribution centers are regularly visited and could provide educational information to the public.
- **Target multi-cultural events.** Deliver messages at sporting events, community fairs, parades, celebrations of different national holidays, and generally any gathering points.
- **Peer Education.** This could include establishing relationships with different organizations and relying on peers to spread the messages by word of mouth, presenting information to local civic organizations, answering health-related questions and concerns at community coordination centers/ public availability sessions or providing training and materials for persons responding to community questions and concerns.

3. Religious Groups

- **Identify the religious organizations that are willing to share mercury health education nationwide.**
- **Identify the key religious people in the community.** These religious leaders may know how to get through to the community in ways that other people would not, in addition to providing insight into outreach materials for the community.
- **Religious groups must be researched to see how allied the groups are between cities.** This research should also encompass cultural considerations that may vary among various regions.
- **Conduct outreach through *botanicas* that emphasizes alternatives to mercury.** Mercury does not need to be used in Santería spells, but mercury makes the spells stronger. A higher level practitioner can do the work to get a more powerful spell. It is more expensive but is an alternative to using mercury.
- **Remember it is not illegal to use mercury. Do not persecute individuals for doing so.** Some people will not stop using mercury, and they have a religious right to use it if they choose.

4. Schools

- **Educate the teachers so that they may in turn educate the children.** This recommendation may include the idea of distributing a one-page alert for children to take home to their parents, possibly piggy-backing ATSDR's one page lead alert. Materials such as comic books that illustrate the dangers of mercury were suggested as possible educational tools.
- **Use school health programs.** Through discussion, the group recognized that certain segments of the population would not be reached through many of the traditional outreach methods. The group suggested that school health programs would be helpful in such cases to reach the children of these communities.
- **Recruit college students to visit schools.** Local environmental college students could come to the schools and speak with the children about the dangers of using mercury.
- **Distribute safety alerts addressing the possibility of mercury exposure in school laboratories.** Participants agreed that parents need to be informed of mercury's continued use in certain educational experiments. A solution to this problem would be to send home a one-page alert describing the situation and possible exposure risks.

5. Health Care Providers

- **Present information to health care providers at national and local workshops.** One target audience includes other health agencies who may not be aware of cultural mercury use. There was general consensus that distributing materials on the risks

associated with mercury to health care providers at national and local conferences, health fairs, and association events represent effective means to communicate this information to communities.

- **Provide education to health professionals.** Another target audience includes health professionals, including alternative or nontraditional health care providers. Building these relationships could result in enlisting some hospitals or clinics in clinical data-gathering efforts. Health professional education includes:

- T Distribution of physician's resource guides (such as those developed by Connecticut DHS and New York City Department of Health (included in Appendix A);
- T Presentation of grand rounds at local hospitals;
- T Direct consultation with health care providers;
- T Distribution of educational materials such as the *Case Studies in Environmental Medicine* to all health care providers in impacted areas; and
- T Providing training for health professionals on the possible psychological effects and neurobehavioral manifestations of mercury exposure.

5. POLICY OPTIONS

A variety of options are available to federal, state, and local agencies that begin to address the issue of mercury use in spiritual and folk traditions. The task force seeks to reduce mercury exposure, by recommending realistic and cost-effective actions that will promote health and well-being while respecting spiritual and folk traditions and community autonomy. This section describes various policy options considered by the Task Force. All available options are discussed below, and their feasibility and suitability assessed in light of these objectives.

5.1 Outreach and Education

A carefully planned outreach program that involves community groups and local health professionals would provide information to mercury users about its risks and available alternatives. Ensuring that health and risk-reduction information come from sources that are respected by mercury users is critical and requires the cooperation of religious leaders and authors/publishers of related materials. The provision of sample labels through such a program could allow for careful design and attention to cultural and language factors in risk communication not addressed by current labeling law.

ATSDR is best equipped to direct such outreach activities with its network of state and local health departments. The proximity of state and local agencies to, and previously established relationships with, the community will enable them to use effective outreach strategies. ATSDR has proposed a health education strategy focused broadly on the toxicity of elemental mercury in all settings of potential public exposure.

Challenges to community outreach efforts include the following:

- The need to understand and address risk perception issues, cultural and religious belief systems, language barriers, the role of non-traditional health care providers, and resistance by suppliers due to fear of prosecution, litigation, financial loss, etc.
- Message development will need to sensitively separate the dangers of mercury exposure and the social-psychological benefits of folk traditions and religious practice.
- Public health interventions will need to incorporate working with religious practitioners to find safe alternatives to mercury use without interfering with religious practices.
- Many outreach efforts have already been undertaken, but there was no evaluation of their effectiveness. Any new outreach effort must have an evaluation component with outcome measures.

Two important social and political factors present a challenge in outreach to communities that use mercury. First, some of the religions and cultural traditions involved have a history of government suppression and social stigma, leading to secrecy about practice. Second, many practitioners and

botanica proprietors are recent immigrants who may mistrust any “authority” representing federal, state, or local government. One strategy for addressing these issues is to make effective use of other educational efforts to prevent mercury exposure – for example, those targeted toward schoolchildren or people who eat fish. Distributing general information about the hazards of mercury is likely to reach a wider audience and be better received among cultural and religious users.

Mercury use may not be a top priority for groups focused on Latino and Caribbean health because it does not affect as many people as other key health issues such as access to insurance (especially among children), fighting diseases such as cancer and HIV/AIDS, controlling tobacco use, asthma, and prenatal care. Until there are good data linking cultural and spiritual mercury use with adverse health effects, Latino and Caribbean health organizations will be reluctant to get involved. Environmental health issues are a top priority for many of these organizations; for example, the NAHH maintains a hotline for indoor air quality. The hotline provides community members with information on a number of home contaminants including radon, lead, carbon monoxide, environmental tobacco smoke, asbestos, volatile organic compounds, household pesticides, biological contaminants, mercury, and asthma.

More outreach to community groups is needed to gain an understanding of what Latino and Caribbean communities in the United States, and especially those communities that use mercury, know and believe about mercury and its risks. This information is essential for designing effective risk-communication materials.

Working with spiritual consultants within these communities is essential for effective outreach. These spiritual leaders can authoritatively provide information to clients about the use of mercury, and may have knowledge of equally potent, non-toxic substitutes for mercury (Section 1.3). It is important for public health workers to understand the role of spiritual consultants as medical practitioners and businesspeople in the community to assess the opportunities for the integration of less toxic and equally effective substitutes for mercury.

Several different designs already exist for community outreach and education activities, but their effectiveness has not been evaluated. Persons involved in community outreach need to be clear about the expected outcomes, and the role of community groups, community leaders, local agencies, and federal agencies in these efforts.

Prototypes from New York City, Connecticut, Los Angeles, and Chicago were reviewed, as well as outreach strategies developed by EPA and ATSDR. Some key issues are discussed below.

- **Specific or general?** Some suggest that a more general approach to education about mercury and all its sources in the home will be better received by Latino and Caribbean communities, because it does not single out a stigmatized practice. Others worry that a general approach weakens the emphasis on practices that are potentially responsible for the largest exposures.
- **Role of community leaders and organizations.** Working with individual community leaders (physicians, priests, social workers, and spiritual consultants) and organizations holds promise for reaching out with credibility to a large number of

people. However, if this issue is not a priority for many leaders or groups, the message could get lost. Gaining the trust of these individuals and groups may also be challenging for federal or local agencies that approach them, especially if their local record on health issues has been lacking.

- **Role of state and local DOHs.** State and local health departments and environmental agencies are a critical link to implementing any outreach plan, because their proximity to communities is a great advantage for follow-up. If agencies have good working relationships with community organizations or leaders, the effort could go quite smoothly. Some agencies may not have the right contacts with the population they are trying to reach in this effort, and may have resource limitations that necessitate pursuing other priorities.
- **Role of CPSC, EPA, ATSDR.** Federal agencies can serve as a resource center that follows efforts in every region and tracks successes and challenges to be addressed, sharing information with local agencies. They can work to ensure consistency in the effort, so that communities are treated equally in the process. Federal agencies can provide an overarching plan and see it through to implementation by working with the state and local agencies. They are limited in their ability to follow through on a community level or to provide oversight of state and local activities.

The effectiveness of community outreach is more likely to be long-lasting than punitive approaches are, or those that seek to control the sales of mercury rather than the demand for it. Communication materials have already been developed by a number of community and governmental groups, but the process has broken down at the point of community distribution. Working with community groups to disseminate this information effectively should be a top priority.

5.2 Research Funding

EPA has already used its research-funding capabilities to understand better the extent of this problem in Connecticut, Illinois, and New York. Similar studies could be funded to answer a number of questions, including characterizing the extent of the problem, better understanding specific uses of mercury and their cultural contexts, and evaluating the effectiveness of outreach and education activities. EPA's Office of Research and Development has identified cultural and religious uses in its mercury research strategy, but has not funded any additional studies. Experience to date indicates that research efforts are effective when community members are positively engaged. Small research projects are likely to carry large benefits for sponsoring agencies. State and local health departments would benefit greatly from sponsoring local studies in their area to provide local knowledge and to establish relationships with the community.

5.3 Regulatory Information-Gathering Provisions

Dr. Wendroff has called for EPA or CPSC to subpoena sales records of *botanica* wholesalers. Were such information gathered, it could provide a bounding estimate of mercury sales. The two most likely justifications for government intervention in this case would stem from either labeling violations, the jurisdiction of CPSC, or from violations of occupational health limits for mercury vapor, the jurisdiction of OSHA. CPSC's information-gathering authority is narrowly directed to

obtaining products and product labels[141]or obtaining records related to interstate commerce[142]. CPSC and OSHA have few resources to support such action.

Under certain circumstances, EPA could conceivably use CERCLA 104(e)[143]or similar provisions in other environmental statutes to query *botanica* wholesalers about the quantities of mercury that come through their businesses. The information on sales would be gathered to estimate the likelihood of an environmental release from mercury spills during the packaging process (mercury is poured into gelcaps), or from leakage or failure of mercury-filled gelcaps, which are more delicate than other containers typically used to store or transport mercury. Clearly, occupational and consumer exposure are the primary concern here, not environmental releases, thus suggesting that CERCLA may not be the most appropriate statute for gathering this information.

It may be easier to gather information at a local level, where there may be more complete knowledge of the businesses and populations involved. However, state and local agencies may have less authority to acquire this type of information.

5.4 Labeling Mercury at Point of Sale

There are several ways to support labeling of mercury that is sold in *botanicas*. The FHSA[133] contains provisions for the labeling of hazardous substances, described earlier in this report. CPSC is charged with enforcement of labeling regulations. The CPSC's authority is broad, but its resources limited, so that the commission's actions are usually targeted toward large distributors or corporations. The CPSC has taken action (via enforcement letter) against major suppliers of mercury to *botanicas* and *botanica* wholesalers. The problem now lies with many small distributors, rendering enforcement activities resource-intensive for CPSC.

FHSA is very general in its labeling requirements, such that enforcement of the law may not ultimately lead to effective risk communication. For example, although the CPSC recommends that labels be multilingual to reach all potential users, this is not actually required by the FHSA. Local and state labeling statutes may also apply, and may have stronger requirements that lead to more effective labeling.

There are three primary enforcement approaches for federal, state, and local officials:

- **Voluntary compliance.** If community outreach is successful, it may be possible to work with *botanicas* toward increased voluntary compliance with labeling regulations, or the inclusion of other warning information – for example, a brochure – with the product at the point of sale. A sample label template photocopied for distribution by each establishment, for example, could be shared in a cooperative manner by local environmental or health departments, or community organizations. This is a “harm reduction” approach that would work with *botanicas* to provide more information on their product. There may be some resistance to voluntary labeling, because of anticipation of decreased sales if the product appears hazardous.
- **Non-punitive inspection visits.** This approach would consist of informing *botanica* proprietors of the law, then visiting to check for compliance. Non-compliance would be met with a warning or a strongly worded request for compliance. In the New York area, this approach has been implemented, and many *botanicas* now deny selling mercury, although it can be purchased by insiders. Such an approach is difficult to implement in a manner that is perceived as truly non-punitive by the community, especially when *botanicas* are singled out for inspection, while other stores that sell unlabeled mercury (e.g., plumbing supply or hardware stores) are not inspected.
- **Punitive fines.** A more punitive approach would involve inspections and fines, which fall under the jurisdiction of the CPSC or state and local agencies, where applicable. Such an approach is time-intensive, requiring the redirection of the efforts of the small number of inspectors to police potentially hundreds of *botanicas*. The CPSC does not have the power to recall the product, but can ask that it be labeled in the future. A fine of up to \$3,000 may be imposed under the FHSA when a hazardous substance is found to be sold without a label, or mislabeled. Punitive enforcement would likely have a negative community impact, adding to mistrust of government officials and interfering with other methods to mitigate exposure. This approach is likely to drive mercury sales underground, and not ultimately address the problem of indoor mercury use.

5.5 Supply Limitation

Sections 6 and 7 of the Toxic Substances Control Act (TSCA)[130]and Section 7003 of the Resource Conservation and Recovery Act (RCRA)[144]might be explored as avenues that could potentially be used at the federal level to stem the supply of mercury from wholesalers to retail *botanicas*. Better data are necessary to document how widespread the problem is before a determination can be made on whether an action might be justified under TSCA to restrict the sale of mercury for these particular religious and cultural uses.

Other reservations and concerns were raised about a supply-limitation approach. Regulating only against *botanica* retailers could be construed as a violation of the First Amendment: the Supreme Court has struck down laws that impact only certain religious groups[145]. Regulating *botanicas* alone would also mean that mercury would continue to be available through other means; for

example, by breaking open thermometers. A crack-down targeted to these communities may worsen already strained relations with immigrant populations, drive mercury sales underground without significantly impacting use, and hamper outreach efforts. Thus, a TSCA or RCRA action would have to be broader and impact the use of mercury in other consumer products as well. Such an action would certainly be resource intensive, and may not find political support at this time.

State and local governments may have more flexibility and less political resistance in proposing or implementing similar policies. Many state and local agencies have sponsored exchange programs for mercury thermometers or banned the sale of mercury-containing consumer products in their jurisdiction, or both. A national effort to remove mercury from schools[146]has resulted in several states and local jurisdictions passing legislation on mercury elimination.

5.6 Exposure Limitation

Botanicas and wholesalers are workplaces with potentially high mercury levels because of the packaging activities that may occur there. NIOSH recommends occupational exposure limits at 50 $\mu\text{g}/\text{m}^3$ as an 8-hour (TWA)[22], but this standard was set in the 1970s, and both the ACGIH and WHO have lowered their recommended TWA to 25 $\mu\text{g}/\text{m}^3$ in recent years[23].

An approach to reducing domestic exposure or mitigating the effects of exposure in the home involves mandating or encouraging testing of dwellings for mercury vapor when the mercury is sold, or establishing a “right-to-know” for buyers or new tenants, as in some states require for radon or lead. Similarly, a local or state policy promoting routine testing of children for mercury at a certain age, as is done for lead, may be helpful in identifying chronic exposure cases.

5.7 Technical Assistance and Response

RCRA 7003[144]and CERCLA 106(a)[147]both provide for remedial actions when threat of release to the environment exists. RCRA 7003 is more flexible in determining what constitutes a “release” but is not attached to funds that could cover some of the costs. A variety of similar laws exist at the state and local levels that govern the cleanup of contaminated buildings. Identifying contaminated dwellings would be difficult to impossible without the cooperation of the residents, because access is required to obtain air samples. Barriers to voluntary reporting to local authorities include the stigmatized nature of the practices, immigrant uneasiness dealing with authorities, and the potentially significant financial burden of cleanup.

If remediation efforts are undertaken without prevention education, it is likely that dwellings or *botanicas* will become re-contaminated by subsequent mercury use. Because of the great expense of mercury cleanups, those who pay for it will want some assurance that re-contamination will not occur.

To date, there has been no demonstrated need for a clinical response strategy tailored specifically to the spiritual and cultural use of mercury , because of a lack of reported exposure cases. There is a need to gather data from existing sources regarding if and to what extent intentional domestic uses of mercury pose a public health threat. The first step before any remediation or clinical response is to define the nature and extent of intentional domestic uses or elemental mercury. If a clinical response is necessary, the response must meet ATSDR’s criterion for a environmental health intervention and would require environmental data that would meet the criteria for a public health

hazard. Should it become necessary to develop such a strategy, ATSDR can provide guidance in public health practice through ascertaining the public health implications of exposure scenarios and the development and adaptation of the current response strategy. ATSDR can assist in developing an integrated risk management protocol on the basis of environmental and biological sampling that includes the following:

1. **Development of exposure history screening tool** to identify individuals at risk for mercury exposure and in need of further investigation. This tool would likely be a mailout survey or survey in connection with a call-in hotline at a local health department or community information center in conjunction with a national community and health provider plan. Positive screens will be followed up with “exposure driven” sampling and biological sampling, described below.
2. **Standardized analysis and biological sampling strategy.** ATSDR can facilitate collection of biological samples by providing training and education to health professionals on urine mercury collection and interpretation. ATSDR can establish a mechanism between the states and National Center for Environmental Health to analyze the biological samples. A standardized analysis and sampling strategy will strengthen risk management decisions to protect public health.
3. **Development of detailed exposure history during biological sampling;** a more detailed exposure history will be elicited to help identify exposure sources, routes, intensity, duration, and frequency, as well as other individuals who may be exposed.
4. **“Exposure driven” environmental samples** could be taken in human contact areas of known use, to ensure that other family members or persons who come in contact with mercury vapor can be identified. Without these data it would be difficult to document the exposure source. To prevent further exposure, finding the source is imperative.
5. **Integrated clinical evaluation and referral protocol** to evaluate and characterize exposure to mercury and related health effects, to facilitate appropriate referrals and follow-up of exposed individuals. Clinical referral networks would need to be established with the Association of Occupational and Environmental Health Clinics including Pediatric Environmental Health Specialty Units to consult with physicians who have questions and concerns regarding the diagnosis and treatment of patients exposed to metallic mercury. Clinical evaluations for those determined to be exposed allow early detection and prevention of adverse health effects among highly exposed persons. Experts in occupational and environmental medicine perform exams on eligible patients, including appropriate medical and exposure history, physical exam, lab work, follow-up, and referral as necessary. The protocol does not provide for treatment. Before clinical evaluations, a plan for continued follow-up of any conditions discovered shall be in place in conjunction with local and state health departments.

6. RECOMMENDATIONS

In Chapter 5, the Task Force describes various policy options for addressing the issue of spiritual and folk uses of mercury. This section focuses on those actions the Task Force recommends be taken by various governmental and non-governmental organizations. These recommendations are those of the Task Force members, and are not binding on any organization. The Task Force recommendations seek to reduce mercury exposure by recommending realistic and cost-effective actions that will promote health and well-being while respecting cultural traditions and community autonomy. The Task Force recommends approaches that rely primarily on community outreach and education activities to inform mercury suppliers and the public about mercury's risks, and encourage the use of safer alternatives. Because there continues to be a paucity of data on the extent of use of mercury for these purposes, the fate and transport of mercury indoors, and the exposure that might result from these uses, the Task Force prioritized a number of areas for further study and research. The Task Force recognizes there are many competing priorities for research, and that government agencies, and non-governmental organizations must balance these recommendations against other existing priorities.

6.1 Community Outreach and Education

A coordinated effort between state and local health departments and local community organizations can help inform mercury suppliers and the public about mercury's risks. Government agencies can play a supportive role in these activities.

EPA/OERR

1. **Develop a brochure on mercury describing its hazards and what to do if mercury is spilled.** This brochure will serve as a template that can be used by local groups in designing their own communications. The brochure is intended primarily for distribution via the Web.
2. **Produce a written statement for distribution to community groups on the do's and don'ts of mercury use.** This was widely requested by forum participants, this "official message" should also include messages from the brochure and emphasize the importance of community leaders in outreach.
3. **Encourage funding** to assist CBOs and local health departments involved in outreach and education activities.
4. **Work with various EPA offices to incorporate mercury in existing education programs, where appropriate.** Because of the perceived success of programs addressing lead and asthma, there was general support for incorporating the issue of mercury and its health effects into existing programs in the Office of Children's Health, the Office of Indoor Air, and the Office of Toxics. It would be particularly effective to add cultural mercury use issues to the indoor air hotline, and to EPA's Tools for Schools kit.

ATSDR

1. **Encourage state and local health departments** to partner with CBOs in their area and develop an effective outreach strategy, as outlined in the next section.
2. **Encourage the addition of the issue of mercury to existing education programs, where appropriate.** There was general support for incorporating the issue of mercury and its health effects into existing programs that deal with similar health issues, such as Indoor Air Quality Programs (e.g., carbon dioxide and lead); Asthma Programs; and Prenatal Care Programs. The Woman, Infants, and Children (WIC) approach is a good model. Mercury exposure questions should be included on the NHANES and HANES surveys. Secondhand exposure should be included in another line of questioning, such as how long has the exposed person lived in their residence, etc. Early education childhood prevention programs should follow or be attached to lead questions.

Regions/Local Health Departments/CBOs

1. **Plan, implement, and evaluate local education and outreach activities.** Much of the outreach and education on mercury use is necessarily local. Forum participants agreed that grassroots education efforts are most likely to be effective. Although federal agencies can provide general guidance about the content of a warning message about mercury use, it is up to state and local health departments working with CBOs to tailor the message to the local audience and deliver the message effectively. The collective wisdom compiled from the participants in the forum on Ritualistic Uses of Mercury on conducting outreach and education can be found in section 4.5. There was consensus that partnerships between local and state health departments and CBOs are most effective at promoting mercury programs.

Community-Based Organizations

1. **Communicate with publishers and authors of religious/spirituality books** that contain mercury spells, to request inclusion of a specific note about the risks of using mercury and how to reduce risk in practice – or a consideration of alternative spells that use non-toxic substances.

6.2 Research Agenda

The following key research areas should be prioritized against other existing priorities:

1. **Clinical studies** to identify elemental mercury levels in people. Ideally, levels of mercury would be examined in the bodies of mercury users versus a control group. Twenty-four hour urine mercury samples could be obtained rather than spot samples, and the mercury could be speciated. Follow-up would connect exposures to particular sources and use patterns. Given the real-world constraints imposed by funding issues and the stigma associated with cultural mercury use, some modifications will have to be made. For example, anonymity and the convenience associated with spot-urine sampling are needed to attract participants. A simplified research strategy might only consider base screening mercury levels in Latino and Caribbean communities versus other communities. Although researchers should strive toward detailed measurement studies where possible, the studies should, at a minimum, measure the incidence of exposure and impact of mercury on the community. Incorporation of mercury tests into other routine tests – for example,

child blood-lead levels – might be an effective way for local clinics to collect useful data. ATSDR has IRB guidelines that govern clinical studies involving human subjects, and these must be followed for any clinical study.

2. **Ethnographic research** to identify the needs, beliefs, and exposure patterns in specific subpopulations, and to understand the frequency and extent of different uses, sales rates, and mercury supply chains. Such research would better characterize the mercury-using population, illuminating how mercury is used and its exposure implications, as well as its cultural meaning or significance. Identifying safe alternatives for mercury used by practitioners in a variety of cultural and religious contexts is also desirable. ATSDR will not participate in any research efforts pertaining to altering religious practices. Participant observation should be a particularly effective research tool for this work.
3. **Risk perception and risk communication research** that evaluates the effectiveness of communication materials and outreach strategies, and provides input for improved designs for both. Market research approaches are also valuable here in understanding the audience and designing salient messages with immediate practical application. Stakeholders should be involved in ongoing discussions of risk management, and in the design and evaluation of risk communication materials.
4. **Fate and transport studies** of mercury in indoor air to better relate cultural use to acute and long-term exposure levels, and to develop models to predict indoor concentrations and residence times. Air measurements in vehicles, residences and *botanicas* are needed to validate these models and measure typical exposure levels stemming from cultural and religious uses.
5. **Epidemiology and toxicology** studies aimed at understanding low-level health effects of mercury and exploring novel biomarkers for exposure assessment are needed. Small grants (such as those provided in the past by ATSDR and EPA Regions 2 and 5), will be sufficient and effective for sharing key information for most of these studies. Priority should be given to proposals that represent true collaborations with active involvement of community groups with demonstrated access to exposed populations. Private foundations may be a source for funding on this issue. Some academic professional organizations in sociology and anthropology may provide small grants for new projects in this field. Finally, the federal and state health care and clinical health community may be an additional funding source for many of these studies. The Office of Minority Health in the Department of Health and Human Services, for example, may have an interest in some of these research areas.

6.3 Environmental Monitoring

EPA

1. Provide guidance on the use of generally accepted ambient levels of mercury.
2. Provide guidance on instruments and detection limits to use when sampling for mercury. The NIOSH 6009 method is the standard method used to monitor for mercury. Newer instruments have been developed that are more portable, and can provide faster and cheaper measurements. Guidance is needed on the use of these newer instruments to ensure their precision and accuracy when compared against the standard NIOSH 6009 method.
3. Provide guidance on action levels of mercury.

6.4 Technical Assistance and Response

1. Any clinical response must meet ATSDR's criteria for an environmental health intervention and would require environmental data that would meet the criterion for a public health hazard. If these conditions are met, a response framework would be constructed. ATSDR is prepared to provide guidance in public health practice through ascertaining the public health implications of exposure scenarios and the development and adaptation of the current response strategy. ATSDR is ready to assist in developing an integrated risk management protocol based on environmental and biological sampling, should one become necessary in the future. Any cleanup response to mercury releases on the Federal level must be pursuant to the legislative and regulatory authorities of CERCLA.

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ADDENDUM

Since the last official meeting (August 7, 2001) of The Ritualistic Uses of Mercury Task Force, it has come to EPA's attention that there have been either new developments in the area surrounding mercury use in spiritual and folk traditions or additional references that were not considered by the Task Force.

ADDITIONAL RESEARCH

U.S. EPA Office of Emergency and Remedial Response

Outreach and Education

OERR's Community Involvement and Outreach Center and ATSDR have entered into a \$60,000 cooperative agreement with the National Association of City/County Health Officials (NACCHO) to work with local health departments to develop outreach and education programs designed to raise awareness about hazards of mercury and encourage use of safer alternatives.

Fate and Transport of Mercury

The Environmental Response Team is performing fate and transport studies in Edison, NJ to help understand how much mercury is released during spiritual and folk practices. EPA expects to publish results of the studies in a peer reviewed journal and present findings at various conferences.

New Jersey Department of Environmental Protection

The New Jersey Department of Environmental Protection (NJDEP) is conducting a study to find out more about mercury usage in Santería and other practices and measuring mercury levels in multifamily dwellings. The work is being carried out under the direction of Alan Stern of NJDEP, Michael Gochfeld of the Environmental and Occupational Health Sciences Institute, and Donna Riley of Smith College. The study intends to find out more about mercury usage in Santería and other practices in New Jersey, by conducting interviews with mercury users in Union City and West New York. The santero member of the research team has currently conducted 22 interviews with santeros/as, espiritistas, and other practitioners. During the interviews, discussions were held on the ways in which they do or do not use mercury in their work. The other portion of this study is concerned with measuring mercury levels in multifamily dwellings in Union City and West New York, in block areas with 80+% Latino population, within 0.5 miles of *botanicas*, and in Montclair, NJ, a predominantly white, non-Hispanic community with buildings of similar size and age. The Lumex atomic absorption spectrometer was used to obtain data in the common areas (lobbies and hallways) of these buildings. The final report will discuss the findings of this study in greater detail.

U.S. Department of Housing and Urban Development Office of Healthy Homes

The Department of Housing and Urban Development agrees that the increase in public awareness in general about the risks of mercury exposures is essential. HUD's Office of Healthy Homes and Lead Hazard Control is tracking the progress of research efforts underway at the National Center for Environmental Health and other research organizations. This information will also provide health care providers with the information they need to target specific populations of children for routine mercury screening. To supplement current outreach measures, the Office of Healthy Homes and Lead Hazard Control has expanded its efforts in this area, briefing HUD's regional environmental specialists of the risk factors associated with mercury exposure and developing an

information packet for HUD field offices, Public Housing Authorities and other HUD clients, that will include material from the Task Force report.

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APPENDIX A: OUTREACH AND EDUCATION BROCHURES

- 1. 1991 Consumer Product Safety Commission Alert: *Mercury Vapors are Hazardous***
- 2. 1994 EPA Office of Pollution Prevention and Toxics Information Fact Sheet: *Hazards to Consumers Using Metallic Mercury In the Home Environment***
- 3. 1994 EPA Mercury Alert**
- 4. 1995 EPA Office of Emergency and Remedial Response: *Warning - It's Dazzling, It's Slick, It's Awesome, It's Mercury, and It Can Kill You!!***
- 5. 1997 EPA/ATSDR: *National Alert***
- 6. EPA Office of Emergency and Remedial Response National Mercury Brochure Draft: *Protect Your Family from Mercury in Your Home***
- 7. Puerto Rican Family Institute: Mercury and Your Health: *How to Prevent Metallic Mercury Poisoning***
- 8. Puerto Rican Family Institute: *Public Health Education: Bodegas***
- 9. Hispanic Health Council Environmental Health Unit Information Booklet No. 1, Hartford, CT: *Metallic Mercury and Your Health: An Educational Guide for Health Care Providers and Azogue Distributors***
- 10. Concilio Hispano De La Salud Unidad De Salud Ambiental Pamfeto No. 1, Hartford, CT: *El Azogue (Mercurio Metalico): Y Tu Salud: Una Guia Educacional Para Proveedores De Servicios De Salud Y Distribuidores De Azogue***
- 11. Hispanic Health Council Environmental Health Unit Information Brochure No. 2, Hartford, CT: *Azogue and Your Health: How to Prevent Metallic Mercury Poisoning***
- 12. Concilio Hispano De La Salud Unidad De Salud Ambiental Pam Informativo No. 2, Hartford, CT: *El Azogue Y Tu Salud: Como Prevenir Envenenamiento Con Mercurio Metalico***
- 13. New York City Department of Health: *Metallic Mercury Poisoning***
- 14. New York City Department of Health: *Metallic Mercury Exposure: A Guide for Health Care Providers***

At this time Appendix A is not available via the Web. Please E-mail Karen L. Martin at martin.karenl@epa.gov to request a copy of Appendix A.

APPENDIX B: MINUTES FROM FORUM PANELS

The viewpoints expressed in these minutes are solely those of individual forum participants and not necessarily those of the Environmental Protection Agency, Agency for Toxic Substances and Disease Registry, Consumer Product Safety Commission or the Ritualistic Uses of Mercury Task Force.

Panel Session I: Members of Religious and Cultural Traditions That Use Mercury

Eric Canales

Eric Canales works at the New York Academy of Medicine as the Community Liaison/Associate Project Director at the Center for Urban Epidemiological Studies. Mr. Canales is an ordained priest in Palo Mayombe, with is an expression of African spirituality. He has worked with Pastor for Pastor, an organization that informs clergy of health disparities and educates these leaders in intervention-based programs. In addition, Mr. Canales has consulted with the EPA, Montefiore Hospital, and the City of New York Department of Health on the cultural and religious uses of mercury.

Palo Mayombe originated in Africa, specifically, from the Bantu religion. Palo Mayombe is well recognized in Africa and Afro-Caribbean communities and has also been embraced by many European and Japanese communities. Mr. Canales pointed out that the increasing Latino population in the United States brings with it an increase in the number of people practicing religions of Afro-Caribbean origin. Despite the predominant focus on Latino and Caribbean populations, Mr. Canales indicated that many other cultures that use mercury are not being targeted, for example, Hindus and Native Americans. In addition, the diabetic community in East Harlem commonly uses mercury for healing. In his experience, mercury is not used to a large degree in Palo Moyombe and if it is used, it is contained in a prenda. Mr.. Canales described a prenda as a consecrated container about the size of a soup tureen that contains a mixture of natural things, possibly mercury. As the foundation for religious belief, the prenda is sealed and is never opened again. Mercury use is not widespread across Palo Mayombe practice. Mr. Canales explained that mercury is a component of the prenda because it is part of nature, part of what God has placed on this earth, like the wind, trees, and ocean. Palo Mayombe is similar to many Native American religious beliefs in that Palo Mayombe uses things like mercury from nature. Mercury will most likely remain in use. Rather than trying to take it out of the practice, Mr. Canales suggested education to help people think about the risks involved in using mercury.

Mr. Canales stressed the importance of reaching the right people, in particular religious leaders and ordained practitioners. Godfathers and Godmothers (spiritual mentors who offer guidance to new initiates, sometimes referred to as “children”) need to know hazards of mercury; this knowledge may in turn be passed onto their children in the faith. In his opinion, Mr. Canales stated that many who prescribe mercury are unaware of its dangers. Although the New York City Health Department launched a commendable education campaign on mercury hazards, a grassroots initiative is necessary to ensure the message is delivered to the appropriate audience and subsequently understood.

Mary Jane Garza

Mary Jane Garza is a writer and artist who has been initiated into Santería, Reiki, lymphatic massage, and Curanderismo. She has presented many workshops to various healthcare organizations on promoting cultural diversity and sensitivity.

Ms. Garza began her presentation by expanding on the notion of diversity brought up by Mr. Canales by noting that mercury use may vary by region as well as ethnicity. To prepare for the forum, she visited various *botanica* owners and spiritual healers in her home town of Austin, Texas, to discuss the use of mercury. The *botanica* owners stated that mercury was not used very much, but reported that about 25% of their patrons request mercury for various home remedies and religious rites. Many *botanica* owners reported that do not sell mercury because of the dangers associated with its use; in addition they believe the sale of mercury is illegal in Texas. In Ms. Garza's experience, mercury is not heavily used in Curanderismo; however, it seems that those who are asking the botanicas for mercury are the more recent immigrants. Ms. Garza noted that all the *botanica* owners she spoke with expressed a desire for more information and handouts on mercury exposure for their customers. Ms. Garza then inquired into local public schools regarding the use of amulets or necklaces containing mercury. The schools, which had a high number of Latino students, did not indicate that such amulets were commonly worn by the students.

Americo Paez

Americo Paez was initiated as priest of Orisha worship, also known as Santería, at age 16. In April 2000, he helped found the Lukumi Church or Orisha, the first church of its kind to be recognized as a nonprofit organization in the state of New York. Mr. Paez provides religious and cultural training to priests and all interested peoples, teaching the ways of the ancestors. One of the principal goals of the training program is to organize practitioners to create an environment of uniform practice.

Mr. Paez began his presentation by providing background on Santería. Santería, which goes by many names, came to the United States from Cuba, and originated among the Yoruba tribes in southern Nigeria. According to Mr. Paez, Santería practices do not use mercury; however, Santería does not prohibit practitioners from belonging to other religions that may practice with mercury. Therefore, just because someone uses mercury and happens to also be a Santero does not mean that the mercury use is a part of Santería.

Mr. Paez emphasized the importance of education. The community of Santería, in addition to other religious communities, is close knit and deeply connected. Community members see each other as neighbors and as family; no one would willingly place another in danger.

Michelle Edouard

Michelle Edouard is employed as Senior Human Services Program Manger for the Miami-Dade County Health Department in Miami, Florida. Prior to her work for Miami-Dade County, Dr. Edouard served as Executive Director of Profamil, Family Planning Association of Haiti, and Chief

of Evaluation for the Ministry of Public Health of Haiti. Her outreach efforts have been acknowledged by USAID, the National Cancer Institute, and the Florida Volunteer Agency for Caribbean Action.

Dr. Edouard served as a speaker on the practice of Voodoo, which she stated is a secretive religion. Voodoo is practiced to varying degrees, with those at the higher levels possessing knowledge of spells and rituals that lower practitioners do not. Such spells are by nature kept secret and passed down through oral tradition. Because it is not documented, it is difficult to know if mercury is involved at such high levels. Dr. Edouard explained that people who practice Voodoo often subscribe to more than one religious faith. For example, approximately 95% of the population in Haiti practices both Voodoo and Catholicism. Although Voodoo is not a centrally organized religion and is practiced differently in varying regions, its rituals are practiced to achieve three basic things: remedies for ills, satisfaction of needs, and survival.

Dr. Edouard stressed that distinction between the core traditions of Voodoo oral traditions passed down for 200 to 300 years and the materialistic expressions or symbols of the faith, such as necklaces. The core traditions, even if these include rituals that involve mercury, will not change, but the materials used in such practices can. People have been forbidden to practice Voodoo through slavery and the suppression by the Catholic church for centuries. The rituals have persevered throughout this time and will not cease.

Before the forum, Dr. Edouard went to a *botanica* and asked how she should use mercury. She was told to rub mercury on her skin with perfume for good luck.

Questions/Comments:

Donna Riley added that in her talks with Max Beauvoir, Voodoo priest at the Temple of Yehwe in Washington, DC, Mr. Beauvoir had distinguished between what he called “magical” use and spiritual or traditional use.

Arnold Wendroff said that he was familiar with a Migene Gonzalez-Wippler book, that lists several spells in which she uses mercury. He proposed that this was evidence that mercury is used in Santería.

Eric Canales replied that not everything that is written about Santería is true and added that Ms. Wippler was not an initiate in the religion. Santería is often associated with similar religions because of its origin; the term Santería was given generically to any religion that used a Catholic saint and practiced spiritism. Santería is a cultural, slave term that encompasses the African roots through Caribbean practice.

Americo Paez added that the most knowledgeable people, those with 30 or 40 years of experience in practicing Santería, are not asked for information. Usually, the first people who are willing to speak are trying to make a name for themselves.

Arnold Wendroff inquired into the reported use of mercury for treating empacho.

Mary Jane Garza responded that empacho was a blocking of any kind, including stomach cramps. She said that she usually prescribes bitter herbs and eggs to treat this condition, not mercury.

Michelle Edouard noted that treatments tend to vary depending on the area. Typically, folk remedies are used because of the lack of access to adequate medical treatment.

Nancy Jeffery directed a question to Mr. Canales and Mr. Paez: Are practitioners knowledgeable about mercury hazards?

The panel responded that recent immigrants are generally unaware of mercury hazards. These immigrants do not have the benefit of mainstream education in schools and various media outlets. Some indigenous knowledge seems to exist showing that ingesting mercury will cause one to become insane.

Mr. Canales emphasized that this issue is a cultural issue, a people of color issue. He has met people who were unaware of the hazards of mercury but who want their children to be protected.

Mark Maddaloni asked Mr. Canales for a better understanding of where mercury fits into beliefs of Palo Mayombe?

Mr. Canales replied that the answer predates history and is an inextricable element of a religious rite. He then reiterated the fact that mercury placed in the prenda is contained, sealed, and never opened again. Eliminating mercury would invalidate the rite. If laws against mercury exist, people will cross state and country lines or break thermometers to get the mercury they need.

Rita Monroy posed a question: If there is such minimal use of mercury in each group, should outreach materials target practitioners of these religions or the general public?

Mr. Paez answered that he thinks it is worthwhile to target people through religious groups and offered the mailing lists of his church.

Mr. Canales said that both the general public and the practitioners should be targeted for outreach materials. By using posters and public service announcements, the impact of mercury exposure to could be minimized for everyone. However, new immigrants and new initiates especially need the information.

Ms. Garza brought up her concern that an educational campaign could backfire by making people curious about mercury, especially if the message is from the government. Government regulation

over cultural affairs is not widely respected and is viewed with distrust. Perhaps the message would be more effectively received if delivered from a church or peer.

Gary Garetano inquired about the frequency and quantity of mercury use?

Mr. Paez replied that mercury is used in bath water, perfume, homes, cars, and businesses such as botanicas. It can be used in a myriad of ways, and often repetitively.

Dr. Edouard stated that people use mercury to attract luck and love; it will be used until these things are perceivably met. Some *botanicas* encourage frequent mercury use because it is better for business. Mr. Canales added that some people use the mercury until a problem is finally solved; for instance, until they get a job. Some people (like Hindus) use it everyday.

Craig Beasley inquired as to which religious denominations use mercury?

Mr. Canales replied that across the board, people use mercury in bath water and burn it in candles, as these are very common practices. Furthermore, he stated that Hindus use a variety of metals in addition to mercury to attract wealth.

Ms. Garza commented that it is common in Texas to put mercury in a glass of water beside the door. She has also heard of one person putting it in food, but not very often.

Mr. Paez brought attention to the dangers of using mercury in liquids, and then discarding the mixture. Often it is flushed down the toilet or left in a field causing environmental hazards and increased risk of exposure.

Question: How educated are botanica owners in religious practice?

Mr. Paez replied that, in New York, a botanica is just a business. Owners are vendors of herbs and remedies but are not experts.

Ms. Garb answered that all the botanica owners that she has dealt within Texas are very knowledgeable about all the religions.

Mr. Canales added that in New York City, botanicas used to sell groceries and were viewed as cultural centers. Today, a botanica owner may be a Santeros, but is usually just seen as a vendor. Ordained priests and recognized elders (godfathers and godmothers) prescribe the rituals and their necessary elements.

Dr. Edouard stated that this was not the case in Florida. *Botanica* owners in Miami and nearby areas are practitioners and are very knowledgeable in the faiths. People come to them for emotional, spiritual, and psychologic healing (there is less emphasis on physical). Delivering the message about the dangers of mercury is difficult because the people who are using it may not understand the

pathology of toxic exposure. They may believe that disease is caused by something in their life that is not spiritually aligned.

Nina Habib Spencer asked if there were alternatives and whether or not people would be responsive to alternative?

Dr. Edouard replied that in recommending an alternative to mercury, it is important to ensure that the alternative is not a toxic substance, that is capable of possibly causing more harm than the mercury. She reported that when asking for mercury at a certain *botanica*, she was offered a stronger powder that was not labeled.

Mr. Canales said that people are not always responsive to alternatives because it contradicts traditions, and generally people are reluctant to change.

Dr. Edouard answered that in Haiti a myriad of herbs are available in rural areas that could be substituted for mercury. However, in urban Florida, many of these herbs are not available. Lacking the ability to practice traditional folk remedies, people then look for something more readily available than modern medicine, such as mercury.

After recounting a story of a woman who went mad after frequenting a botanica and who returned and stoned the store, Clyde Johnson asked panel members if there were concerned about a specific practice that may be particularly dangerous?

Mr. Canales stated that the danger of developmental damage from inhalation of mercury vapor needs to be stressed. Candle burning is very common in New York and is particularly harmful because the exposure to mercury through inhalation. Most communities know that ingesting mercury will make you crazy and therefore rarely intake it this way.

Ms. Garza stated that in Curanderismo, mercury is not a vital part of practice. However, she is concerned about amulets or necklaces containing mercury that are popular in Texas. These can be purchased at *botanicas* along the border of Mexico, are unregulated, and can break easily.

Mr. Paez said he is most concerned about mercury use in floor washes and baths. It is a repetitive practice that relies on constant application.

Mark Maddaloni asked how the mercury is mixed with water?

Mr. Paez answered that you mix it with the water and then attempt to get it on your body.

Mr. Canales added that it is typical to use a little bit of mercury with herbs and a small amount of water.

Gary Garetano asked how mercury is used in candles and whether it was purchased in candle wicks?

The panel answered affirmatively and said that sometimes candles are sold with mercury in wick and the bottom metal part of the candle.

Dr. Edouard added that mercury is sometimes mixed in oil lamps.

Donna Riley asked whether there are special stores that Hindus frequent to buy mercury?

Mr. Canales answered that he was not sure, but knew that some Hindus get their mercury from the botanicas.

Donna Riley asked if the panel had concerns about people following the directions in popular books on Santería and Voodoo found in new age book stores and other places?

Mr. Paez agreed that it is a problem and added that some of the same authors who wrote books on Santería also wrote new age books.

Mr. Canales reminded the group that these books are not bibles. The ancestors shared the practice verbally; it is not written down.

Dr. Edouard agreed and added that a central element of Voodoo is secrecy.

Ms. Garza said that Curanderismo came from the Aztecs, who had documented the faith in libraries. However, once Cortez began to persecute the religion, it became an oral tradition.

Clyde Johnson asked if a relationship exists between mercury use in the Americas and the mercury found in Egyptian tombs?

Ms. Edouard felt that this may be a possibility. She explained that there is no word for mercury in Africa; however, the term that is used for mercury in Haiti (*vidajan*) is a derivation of the French phrase *vif argent* (quick silver). This would imply that mercury use is not of African origin, but European.

Arnold Wendroff added that in his studies he has not found evidence of mercury used in African religions. He said that he believes that it came from Europe and that the Spanish brought it to America to extract gold and silver, possibly attributing the metal with the characteristic of attracting wealth. It was also widely used as a cure for syphilis, portraying the healing powers of mercury.

He then asked that if the health education community were able to demonstrate the deleterious effects that mercury has had on certain populations, will people be convinced of the dangers and change their practices?

All panelists agreed that people would be amenable to change if the message is clear, practical, and comes from a trusted source.

Mr. Paez added that people have preconceived or illegitimate ideas about different practices, but when they are shown the right way, they are usually willing to change. The older generation is more resistant to change and does not want to feel that they have been wrong about something for all this time.

Do you think that more younger or older people are using mercury?

The panel replied that it is both young and old who are using mercury. Mostly it is people who are new to the country.

Mr. Canales said that some people buy 5 to 10 capsules per month. Some elderly people are die-hard users. He stated that outreach on other health issues does occur at group gatherings and places of worship during celebrations. For example, some groups pass out information about sexually transmitted disease and distribute condoms. Such intervention needs to be constant because the community is always changing and transforming.

Dr. Edouard stated that in Miami, a great amount of cross-cultural interaction and exchange occurs. At flea markets, Haitians and Latinos exchange information and practices, despite the fact that they may not share the same language or culture.

Panel Session II: Health Educators with Latino and Caribbean Communities

Lisa Rose-Rodriguez

Lisa Rose-Rodriguez has been a devotee of Santería for 8 years. She is also pursuing a master's in public health at the University of Connecticut in epidemiology. She has undertaken "Mercury Poisoning During Santería Rituals" an independent research project, with the blessing of the Connecticut Department of Environmental Health. As a devotee and a graduate researcher, Ms. Rodriguez conducts workshops for health care workers, social workers, and other health and human services professionals so that they may build rapport with clients who are Santería practitioners, influence better outcomes, and increase service utilization.

Ms. Rose-Rodriguez was the first panelist to speak. She is of Portuguese ancestry and lives in Connecticut. She is currently pursuing a graduate degree at the University of Connecticut in which she works to link together culture and epidemiology. Ms. Rose-Rodriguez is a devotee of Santería, but is not an initiate. With respect to the initiates present, she said that she disagrees with Eric Canales and Americo Paez in their assertion that the rituals will not change despite outreach efforts.

Ms. Rose-Rodriguez began her presentation by defining many of the terms used and placing them in the appropriate context. Santería means "of the saints" and is the synergistic union of the Yoruba religion and Catholicism derived among the slave communities of French, Spanish, and Portuguese slave owners. The Yoruba was the largest ethnic group removed from Africa. Ironically, the purveyors of the Yoruba cultures in America are the Cuban, Caribbean, and Latin American communities, rather than the African-American communities. *Orisha* is a Lukimi word for deity. *Brujeria* is a Spanish (primary Mexican-Spanish) word for witchcraft or person of knowledge.

In Ms. Rose-Rodriguez's experience, mercury is used most often with worship of *Eleggua*. There are different levels of worship. For example, a banishing can be conducted by using mercury on a person's house or purchasing a "run-devil-run" candle at a *botanica*. An increase in levels of magic relates to a stronger effect. Each level is a higher exposure to mercury.

Ms. Rose-Rodriguez stated that if white men went to a *botanica* to distribute brochures, they would be treated with hostility as an outsider. Ms. Rose-Rodriguez said that she had distributed a survey to practitioners asking them about their level of initiation and the level that they prescribe mercury. From the surveys, Ms. Rose-Rodriguez noted that most devotees are female and most commonly requested works were those thought to bring love and protection. She also brought a catalog to the forum from which mercury products can be ordered from a California-based company that sells.

Ms. Rose-Rodriguez said that in her experience with the Connecticut Department of Environmental Health, mercury poisoning cases exceed those of lead poisoning cases. The department sponsors a program that focuses on identifying speech delay and other developmental delays in children; however, it is difficult to separate the origin of developmental delay from mercury exposure given complicating factors of poverty, including lack of prenatal care. It is hard to establish a case

exposure because the use of mercury is secretive and knowledge of its use is inexact. Mercury can be inhaled, ingested, or absorbed.

Ms. Rose-Rodriguez reported that candle dressing has caused some concern in Connecticut hospitals. If the mercury is smeared on top of a candle, there is the risk of inhalation exposure. If it is used in the Wiccan ay, which is to apply the dressing to hands and then smear it on the outside of a candle, there is risk of exposure through skin absorption.

Ms. Rose-Rodriguez had some of the preparations from *botanicas* analyzed for mercury and found that all dedications to the Seven Powers; that is, the seven main deities of Santería, and *Elegguá* contained mercury. These preparations included powders, baths and oils. She concluded her introductory talk with the suggestion that the message for prevention of the practitioner, in outreach materials.

Suzanne Nicoletti-Krase

Suzanne Nicoletti-Krase is a registered nurse and holds a master's of science degree in community health education and a doctorate of education in health education. She is Director of Patient Relations at the Brooklyn Hospital Center. Dr. Nicoketti-Krase has supervised, mentored, and trained students in community outreach research.

Dr. Nicoketti-Krase shared with the forum her outreach experiences with West Indian and Latino communities through a newly developed family practice center through a Brooklyn-based nonprofit organization known as the Church Avenue Merchants Block Association (CAMBA). The CAMBA Center provides one stop shopping for comprehensive primary and preventive health care, case management, and legal assistance that is easily accessible to all members of the community. Center services include family practice/internal medicine, pediatrics, OB/GYN, dentistry, cardiology, radiology, podiatry, optometry, pulmonary function, nutrition, and physical and speech therapy.

CAMBA's health division is dedicated to linking isolated people to primary care. Although not directly related to mercury prevention, CAMBA is useful model for reaching the Haitian, Dominican, and Central American communities. CAMBA's purpose is twofold, to reduce the use of emergency rooms as primary care centers, and to stress preventive medicine. Prior to instituting the program, Dr. Nicoketti-Krase and others conducted a community profile of the neighborhood, noting all area businesses and community organizations in an attempt to make contacts. Realizing that community members might be suspicious of health care providers from outside of the community, the program used these contacts to recruit health advocates from within the community. Representatives from local schools and churches were trained to educated the community and to test for a variety of health indicators, such as blood pressure, glucose levels, and lead poisoning. These trained community advocates brought the message of CAMBA to the people through health fairs, tuberculosis screenings, and parenting classes. A prenatal care program called "Mothers Helping Mothers" was also established.

Dr. Nicoketti-Krase worked to obtain a primary care initiative grant that funded the training of advocates. The grant funded some insurance, materials in Creole and Spanish, transportation, and a quarterly newsletter for those enrolled in the "Stay Healthy Brooklyn Network." Additionally, Dr. Nicoketti-Krase collaborated on another grant for cancer awareness in the Puerto Rican community in Williamsburg, NY. Information was delivered through El Diario and other Spanish newspapers, as well as Spanish radio and television channels. Similar to CAMBA, the cancer awareness program recruited "role models" of health from the community to feature in each newsletter. Examples of topics included pap smears, mammograms, and smoking cessation. Neighborhood people distributed the newsletter and other educational materials to local establishments, especially beauty salons. Each volunteer was also asked to recruit one other volunteer. Dr. Nicoketti-Krase stressed the importance of advocates being multilingual and staffing care facilities with culturally sensitive people.

When planning a community advocate program, Dr. Nicoketti-Krase offered the following insights:

- It is important to know whether community advocates are people who will be respected by the community.
- Competition exists among community-based organizations; be aware of alliances that may hinder relationships with another organization.
- Have a plan for referring people that need further medical attention.
- Set up a system at the hospital or health care facility for handling language and insurance barriers. Educating the administration at the hospital required a lot of up-front internal work.

Abigail Juarez-Karic

Abigail Juarez-Karic has been the Director of Programs for the Puerto Rican Family Institute in Brooklyn, New York, since 1989. She has served as an adjunct professor at the New York University School of Social Work, where she received her master's degree. In 1996, Dr. Juarez-Karic earned a Ph.D. from the Columbia University School of Social Work.

Dr. Juarez-Karic began her presentation by dispelling the misconception that botanica patrons are uneducated, noting that she herself has been to a botanica. In describing her involvement in outreach with the Puerto Rican Family Institute, Dr. Juarez-Karic advised that the best way to get information to Spanish-speaking people was to have another Spanish-speaking person deliver the message. The message should be written simply and regularly played on Spanish radio stations. Her group has also seen positive outcomes from hosting events with food and/or paid audience participation as an opportunity to educate and disseminate information. Dr. Juarez-Karic also noted that women are typically the carriers of health-related messages, which is why distributing health information through beauty parlors is extremely effective.

Nancy Jeffery

Nancy Jeffery is the Director of the Environmental and Occupational Disease Epidemiology Unit in the New York City Department of Health. The unit which is responsible for conducting adult heavy metal surveillance (including mercury). Before Ms. Jeffery's 11 years with the New York City Department of Health, she worked as registered nurse (RN) at Loma Linda University Medical Center in California. Ms. Jeffery was the first RN to be enrolled in and complete an accelerated MPH program in epidemiology.

Ms. Jeffery explained that her experience in epidemiology and public health has not specifically focused on Latino and Caribbean communities; however, she and her department have been intimately involved in testing for mercury in many New York City botanicas. Her department investigates elevated levels of arsenic, lead, cadmium, and mercury. According to New York State law, physicians are required to report elevated levels of heavy metals to the New York City Health Department. Her department occasionally receives reports of elevated arsenic and mercury, but the majority of cases involve lead stemming from occupational exposures. To date, no reported cases of elevated mercury levels resulting from identified cultural practices have been reported.

Given the scarcity of data on mercury exposure, Ms. Jeffery and her group decided to focus on educational outreach as a preventative measure. The department adapted a brochure originally developed in Hartford, Connecticut and translated it into Spanish and Haitian Creole. They also created a brochure for health care providers, bringing awareness to the signs and symptoms of mercury toxicity in children. Overall, the department distributed 4,000 educational brochures to New York City botanicas (those with listed addresses), pediatricians, obstetricians/gynecologists, and general practitioners.

Ms. Jeffery stated that the biggest obstacle to conducting outreach was the ambiguity associated with just how to get the information to people who may have a non-occupational exposure. It seemed to her that it may be more effective to send the message from someone within the community as opposed to someone from a regulatory agency.

Michelle Edouard

Michelle Edouard was also a presenter in the first panel. As the Program Coordinator of the Childhood Lead Poisoning Prevention Program for the Miami-Dade County Health Department, Dr. Edouard has been instrumental in educating the Haitian American and other ethnic minority communities regarding toxic exposure to lead. Dr. Edouard began her presentation by describing the Community-Based Diffusion Model used for education outreach within Latino and Caribbean communities. Dr. Edouard's presentation is included here:

Community-Based Diffusion Model Essential Planning Principles

1. Know the client.

When getting to know your client base, it is important to avoid using broad racial characterizations because of the risk of stereotyping. You should be sensitive to beliefs and needs of the targeted group; learn the target groups educational level, literacy, language preferences and cultural practices; and identify the group's opinion leaders and its unique set of communication channels not easily identified by outsiders.

- a. ***Get To Know Caribbean and Latino Communities***. In the United States, the Caribbean and Latino communities cluster in neighborhoods that provide social support (e.g., in Miami - Little Havana, Little Haiti, and Liberty City). The main languages spoken are English, Spanish, and Creole, but literacy is limited. Most Latinos read at least at a third-grade level, but many Haitians cannot read at all. Cultural practices and beliefs in these communities vary according to county of origin.
- b. ***Get To Know the Haitian Community***. The main language of the Haitian community is Creole, and the literacy level is extremely low. The community consists of Catholic or other Judeo-Christian Faiths; however, many Voodoo beliefs and practices used for spiritual survival developed during slavery were integrated into Catholicism.

- c. ***Get To Know the Latino Community.*** The main language in the Latino community is Spanish and is often preferred despite fluency in English. The literacy level is generally at third-grade level or higher. The Latino community consists mainly of the Catholic denomination, but many practice other Judeo-Christian religions; beliefs and practices vary country of origin. For instance, South American Latinos (except Brazilians) have practices and beliefs inherited from their Indian ancestors, while Caribbean Latinos and Brazilians share many beliefs and practices similar to those of Haitians.

Most public agencies do not have epidemiologic data to support a diffusion effort; therefore, community leaders and solicit their input for addressing target populations (focus groups). Community leaders can provide critical information about the community that may not be available to outsiders, such as familiarity with languages, health beliefs, education and literacy levels; knowledge of communication networks and opinion leaders; and social and professional ties in the community.

2. Assess Target Population for Risk of the Health Problem

Many leaders in Latino and Caribbean communities are unaware that mercury is used in rituals or for any other cultural reason by members of their ethnic group. However, Dr. Edouard noted that her visits to various botanicas in Haitian and Latino neighborhoods revealed that mercury is readily available and widely used. Mercury is well known by Haitian spiritual healers and their customers. Haitians refer to mercury as *vidajan*, the old French word for mercury, *vif argent* refers to quicksilver. Latino spiritual leaders and their followers call mercury by the name *azogue*.

Mercury can be used in a variety of ways. Haitians and Latinos mix mercury with perfume or dusting powder and then rub it on the skin. It is used as an ingredient in some traditional medicines, then ingested, sprinkled on the floor for good luck or used to wash the floors, kept inside vials or charm bags as a talisman, and placed in oil lamps or candles and burned. Mercury is used in these communities for an equal variety of reasons, such as for:

- protection and good fortune,
- warding off evil spirits,
- casting love spells,
- spiritual cleansing, and
- curing stomach ailments

Informal surveys and literature searches conducted show that mercury is mostly used for traditional medicine and as talisman but not often as part of rituals of Voodoo, Santería, or other religions. Rituals are difficult to change, but traditional medicinal uses are possible to alter.

3. Find the message

The right message is essential for a successful outreach campaign. For the behavior to change, the message must be understood. The problem or risk must be relevant to the target audience, and the recommendations must be acceptable. An educational message should acknowledge the importance of the product to the users and why they use. For many, the message will be tempered by considerations of health being more of a concern than respect for the tradition or the religious ritual. When formulating the message, planners should ask the following questions:

- Does protection from evil spirits matter more than health?
- Are alternatives to mercury acceptable to users?
- Are modern medicines available for ailments?
- Is there awareness and adequate access to health care?

Dr. Edouard offered the following as possible sayings to include in messages for the prevention of mercury poisoning:

“ You can get a better spiritual job by using products other than mercury.”

“Ask your Espiritista, Santero, Dokkte Fey or botanica for substitutes for mercury with similar power.”

“You deserve a perfect spiritual job.”

Focus groups serve as an effective method for involving the target population and prevent one from ignorantly entering into a social marketing campaign. Through focus groups, the receptivity of an idea can be tested in the actual target group. Focus groups should be conducted by recording reactions of a sample of 8 to 10 representatives of the target group.

During focus groups for a lead poisoning prevention campaign, the Childhood Lead Poisoning Prevention Program recruited parents of children 6months to 6 years of age from the target ethnic groups (Haitian farm workers, inner-city Haitians, Mexican farm workers, inner-city Cubans, and inner-city African Americans) to discuss values priorities. The results of the focus groups are listed below:

- Parents want a better future for their children (e.g., a college education).
- Parents would like to see the lead in a child’s body (something concrete, tangible).
- Parents want to know what a child with lead poisoning looks like (signs and symptoms).
- Colorful brochures on lead poisoning with photos of children of their ethnic group were preferable.

4. Identify Ways to Deliver Messages

Suggest means for delivering messages to target communities including bus and metro-rail advertising, posters, brochures, personal communication through social networks, broadcast on minority-specific media, participation in community events and health fairs. The three best practices for delivering the lead poisoning prevention message to Latino and Caribbean communities in Miami are:

- The Haitian-American Foundation Experience (radio program);
- National Safety Council Advertisement on Univision (Spanish TV channel); and
- Telesante (Haitian TV show).

Dr. Edouard explained that the ideal communication channels for Caribbean/Latino communities include television and radio media, so that illiteracy is not a barrier. Messages can be delivered at home, work, or in a car. Further more, ethnic and immigrant populations depend more heavily on radio and TV for news and entertainment.

Questions/Comments:

Arnold Wendroff stated that he has been calling the heavy metals disease registry to inquire about mercury poisonings to no avail.

Lisa Rose-Rodriguez replied that this may be due to the fact that many cases of mercury poisonings in the Connecticut disease registry are not directly attributed to a source.

Americao Paez discussed his concern that although he willing to help, he would lose the trust of the botanica owners if after coming forward, the government would fine them for not being in compliance. Should this happen, mercury sales would go underground and be uncontrollable.

Ms. Rose-Rodriguez agreed.

Nancy Jeffery reminded the group that it is not illegal to sell mercury in New York, but that labeling requirements do exist. The New York City Health Department sent a letter to botanicas informing them that if they sold mercury, it needed to be properly labeled. The following summer, a unit from the department visited *botanicas* to inquire about mercury labeling but did not fine anyone.

Recounting a visit that he had made to botanicas in 1991, Arnold Wendroff stated that two shops admitted to selling mercury. Furthermore, he noticed that mercury had been spilled in a botanica and was contaminating the store. He reported it to the Occupational Safety and Health Administration (OSHA). After the botanica was subsequently fined, he found it increasingly difficult to purchase mercury because he is a white male.

Ms. Jeffery reported that when New York City Department of Health sent a group out to the botanicas, it was with an educational motive, not a punitive one. The Spanish-speaking members of the department were sent with the intention not to scare but to inform the owners of an important public health risk. Obtaining funding for outreach on a problem with no reported cases is difficult. Resources have to be allotted to many other health issues. Ms. Jeffery said we need to have perspective. Rather than focus on what did not work, let us move forward.

Clyde Johnson stated that his student who had surveyed botanicas knew of a church where mercury was readily available. In the church, the candles were dressed with mercury treatment. He then asked how widespread this use was.

Ms. Rose-Rodriguez replied that she brought to the forum the catalog from which *botanica* owners purchase items wholesale. All the candles are dressed in this manner (Eric Canales disagrees). It could be a possible survey question: Do you dress your own candles?

Clyde Johnson then asked what would be the best way to get the message to the priests?

Ms. Rose-Rodriguez stated that the first step is identifying them, which is difficult because the practices are secretive and involve complex levels of initiation.

Susana Baumann, New Jersey Department of Health, added that an effort needs to be made to push the involvement of similar “culture officers” to involve in outreach efforts.

APPENDIX C: SCHEDULE OF TASK FORCE PLENARY CALLS

- 1. January 21,1999**
- 2. March 18, 1999**
- 3. June 3, 1999**
- 4. July 29, 1999**
- 5. September 16, 1999**
- 6. October 28, 1999**
- 7. December 8, 1999**
- 8. February 2, 2000**
- 9. March 29, 2000**
- 10. May 11, 2000**
- 11. August 17, 2000**
- 12. October 5, 2000**
- 13. December 18, 2000**
- 14. February 15, 2001**
- 15. March 28, 2001**
- 16. May 9, 2001**
- 17. June 28, 2001**
- 18. August 7, 2001**

APPENDIX D: INTERVIEWS WITH COMMUNITY GROUPS

Interview Questions: Cultural and Religious Organizations

1. What is your involvement in Latino and/or Caribbean faith traditions?
2. How and why is mercury used in Latino and/or Caribbean faith traditions? With what frequency is it used?
3. Are you aware of any health risks associated with the uses of mercury?
4. Where and how would one obtain mercury (botanicas, from chemical supply stores or Internet)? What is the volume of standard purchases? Are there warning labels on the vial?
5. How widespread are cultural and religious uses of mercury?
6. What are possible alternatives to using mercury in cultural practices?
7. How should the hazards associated with mercury be communicated to users? Who should be involved? Who should organize the effort? Who should serve as a point of contact in the community?

Interview Questions: Public Health Organizations

The following questions were asked of individual and organizations that promote public health initiatives and provide various additional health and human services:

1. Are you aware of any cultural uses of mercury in Latino and Caribbean communities?
2. Does your organization regard the cultural use of mercury to be a significant public health threat?
3. If so, what (if any) intervention and/or educational efforts is your organization taking to address the issue?

TABLE D-1 INTERVIEW REQUESTS

NAME	ORGANIZATION	LOCATION	COMPLETED
Rita Monroy Adolph P. Falcón Eliana Loveluck	National Alliance for Hispanic Health	Washington, DC	Yes
Miguel Flores Cristina Encinas	Latin America Youth Center	Washington, DC	Yes
Dr. Sarah Lister Donald P. Hoppert	American Public Health Association	Washington, DC	Yes
Brent A. Wilkes	League of United Latin American Citizens	Washington, DC	Yes
Mauricio Pardon Ojeda	Pan American Health Organization	Washington, DC	Yes
Max Beauvoir	The Temple of Yehwe	Washington, DC	Yes
Earl Lopez	National Institute for Latino Development	Washington, DC	No
Rev. Mark F. Hughes	Saint Gabriel's	Washington, DC	No
Rev. Horace Grinnell	Saint Anthony of Padua	Falls Church, VA	No
Rev. Msgr. W. Ronald Jameson	Cathedral of Saint Matthew the Apostle	Washington, DC	No
Rev. Tarsicio Buitrago	Blessed Sacrament Church	Alexandria, VA	No
Rev. Gerard Creedon	Saint Charles Borromeo Church	Arlington, VA	No
Joe Garcia	Cuban American National Foundation	Miami, FL	No
Raul Yzaguirre	National Council of La Raza	Washington, DC	No
Larry Gonzales Arturo Vargas	National Association of Latino Elected and Appointed Officials	Washington, DC	No
Sue De Larosa	Sierra Club	San Francisco, CA	No
Linda Hanten	National Hispanic Leadership Institute	Washington, DC	No
Vanny Marreo	National Conference of Puerto Rican Women, Inc.	Washington, DC	No

NAME	ORGANIZATION	LOCATION	COMPLETED
Jennie Torres-Lewis Manuel Mirabal	National Puerto Rican Coalition	Washington, DC	No
Migdalia Rivera	Latino Institute	Chicago, IL	No

Interview Summary 1 - The National Alliance for Hispanic Health

Date: October 4, 2000

Interviewee (s): Rita Monroy - Executive Director, NAHH
Adolph P. Falcón, MPP, Vice President, Center for Science and Policy
Eliana Loveluck, MSW, Director, Center for Consumers

Background and Purpose

On October 4, 2000, Peter Redmond and Donna Riley of the U.S. EPA met with key members of the National Alliance for Hispanic Health (NAHH) in Washington, DC. The purpose of this meeting was to:

- Establish new relationships with members of NAHH and to reinforce existing ones
- Determine the priority of mercury poisoning on the NAHH agenda
- Seek feedback on an outreach strategy aimed at reducing mercury exposure in Caribbean and Latino communities.

Results

Representatives of NAHH spoke freely and candidly about the problem of addressing cultural uses of mercury in the Latino community. The interviewees also shared their insights on the efficacy of the Task Force's efforts, past, present, and future, in dealing with the issue. The following issues were identified as the most inhibiting factors regarding the Task Force's progress.

1. There is a lack of clinical data linking the sale and use of mercury to adverse health effects.

There has been a lot of discussion within the Task Force over the issue of cultural exposure to mercury; however, there are not empirical data exists to support the claims by some that this represents a public health crisis. NAHH has yet to see conclusive evidence in clinical studies indicting that a significant problem with mercury poisonings exists among the population at large, let alone within the Latino community. Even less information is available documenting the health implications of mercury exposure through cultural and religious uses. As a public health advocacy group for the Latino community, NAHH takes seriously each campaign it investigates and subsequently endorses. NAHH judiciously reviews issues on the basis of their validity, as well as potency as a public health threat. As a result, NAHH preserves the integrity of its actions and messages, in addition to its credibility in the Latino community. NAHH cannot move on an item such as cultural and religious mercury exposures without strong data indicating that a problem exists. NAHH also felt that the current paucity of human data contributes to the lack of participation of many organizations originally involved in the Task Force.

2. Specifically targeting communities that incorporate mercury in cultural practices will only isolate them further, hindering any intervention or outreach efforts.

Headquarter nationally, NAHH is structured around a network of Latino health care providers and consumers. Members consist of community based organizations and individuals, committed to educating the Latino community on health matters and strengthening their health and social service infrastructures. This grassroots approach is ideal for reaching Latino communities isolated from mainstream media and health care services. However, even NAHH admits difficulty in reaching religious practitioners such as Santeros. A campaign targeting cultural ceremonies of Santeria may be perceived as a frontal assault on sacred beliefs, causing further isolation and caution toward outsiders. NAHH believes that by utilizing the cultural and religious uses of mercury as the primary vehicle for intervention, the Task Force will not be successful in curbing its use. NAHH stated that it is difficult to estimate the number of Santeria practitioners in the Latino community, partly due to its loosely organized structure and secrecy of its practice. Despite this, NAHH felt that cultural and religious use of mercury was not a major force in the Latino community.

3. The Task Force has not responded to actions suggested by NAHH.

Some time ago, NAHH submitted a proposal to EPA for hosting a forum between Latino organizations and scientific community. NAHH claims EPA did not respond to this proposal, hence their gradual decrease in participation on the Task Force. Originally, four to five Latino organizations were involved in the Task Force; however, as time progressed and little activity was displayed on the part of the Task Force, other pressing issues took priority. This is true for NAHH as well.

Recommended Actions

Environmental health issues affecting the Latino community are becoming increasingly important to NAHH. Recently, NAHH released a report stating that reducing the adverse health effects of environmental toxins was a priority in the NAHH agenda. From its standpoint on addressing environmental health issues, NAHH made the following suggestions for the Task Force.

1. Do not focus on the cultural and religious uses of mercury, but broaden the scope to include all possible domestic exposure routes.

NAHH strongly felt that the most effective means for addressing cultural uses of mercury was to include the issue in a broader campaign that examines all possible domestic exposure routes. After discussing the recent events in Chicago which revealed thousands of possible mercury leaks from gas meters, NAHH indicated that using this aspect could open the Latino community to home testing. This approach does not single out the Latino community; rather, it incorporates them with a larger group sharing a similar problem. Furthermore, an incident such as this removes any fear of stigmatization or blame in reporting deliberate use of mercury, and improves the chances for cooperation with regard to indoor air sampling.

2. Solicit clinical data from hospital studies that document mercury exposures through elevated mercury levels in urine or blood.

As a public health agency, NAHH feels that the most effective data will be clinical data to show evidence of incidents of mercury poisoning. Gathering data that document adverse health effects will be easier than going into people's homes and taking environmental samples. Realizing the costs and time associated with national trials, NAHH suggested sponsoring smaller regional studies and extrapolating the data to get an idea of the larger picture.

3. If quantitative data indicate that mercury poisonings are occurring in certain communities, investigate the source.

Once a reasonable estimate of confirmed and possible mercury poisonings has been reached etiology of the exposures may be investigated. Cultural and religious use may only contribute to a small portion of poisoning cases, in which case it is best addressed in the context of all domestic exposures. Only if the cultural and religious use of mercury proves to be a significant public health problem in its own right should the issue be addressed individually. Because of the cultural sensitivity associated with this issue, NAHH stated that public health education and outreach would have to come from a trusted source for it to be heeded by the Latino community.

Interview Summary 2 - The Latin American Youth Center

Date: March 22, 2001

Interviewee (s): Miguel Flores
Christina Encinas

Background and Purpose

On March 22, 2001, representatives of the Ritualistic Uses of Mercury Task Force met with members of Health Education Division of the Latin American Youth Center (LAYC) in Washington, DC. The purpose of this meeting was to:

- Establish new relationships with members of LAYC,
- Determine what, if any, knowledge and experience LAYC has had with mercury poisonings, and
- Seek feedback on an outreach strategy aimed at reducing mercury exposure in Latino and Caribbean communities.

Results

The LAYC is a nonprofit youth and community development organization dedicated to serving at-risk Latino youth. In addition, the group works closely with Vietnamese, Caribbean, African-American and African communities in Washington, DC. The LAYC offers programs in academics, health education, job training, social services, leadership development, substance abuse prevention, housing, arts, humanities, and recreation. The Health Education Division of LAYC is actively involved in grassroots community outreach. Through its health education programs, LAYC focuses on issues such as HIV/AIDS education, family planning and teen pregnancy, and sexual development. Of particular note is the LAYC Teen Health Promoters, a program designed to train local teenagers in peer-provided education and support to teen clients of Mary's Center for Maternal and Child Care and Unity Health Care Upper Cardozo Clinic. LAYC additionally provides a peer support program that encourages youth to resist risky sexual behaviors.

As a community health advocacy organization, LAYC expressed a sincere interest in the efforts of the Task Force. Although active in community health education, particularly youth oriented, neither representative was familiar with or aware of cultural and religious uses of mercury. Before the interview, Miquel Flores informally solicited information from his colleagues regarding the nature and extent of cultural and religious uses of mercury in the Latino community. From this inquiry, Mr. Flores discovered that although Santeria is practiced in the D.C. Latino community, it is not known whether mercury is incorporated in the faith practices. Mr. Flores did learn that mercury can be used in home remedies for various illnesses, and that mercury for this purpose can be purchased in nearby botanicas. It was his belief that despite labeling regulations, many consumers are either unaware that the product being purchased contains mercury, or are unaware of mercury's toxic effects.

Recommended Actions

LAYC felt that the Task Force has two hurdles to overcome in its effort to educate Latino and Caribbean communities about the hazards associated with cultural and religious uses of mercury. The largest impediment is the lack of information concerning the magnitude of this issue. It is not well known who is using mercury in a religious manner, how often, or how much. Despite their willingness to assist the Task Force, LAYC stated that paucity of information prohibits the launching of an educational campaign. The second challenge facing the Task Force is the extremely small and esoteric population being targeted. Attempting to educate what essentially may be an underground community will be difficult, even for groups with intimate ties to the community such as the LAYC.

Representatives from the Health Education Division of the LAYC recommended that the most effective means for addressing the cultural and religious uses of mercury is to conduct a wide reaching campaign that encompasses the hazards of mercury in general. This would include possible cultural and religious routes of exposures through work and/or schools. Christina Encinas, the Health Education Programs Director, recommended that an extremely effective means for distributing this information is through Spanish-language television channels, and by developing education videos in Spanish.

Recommended Contacts

Council of Latino Agencies

Interview Summary 3 - American Public Health Association

Date: March 22, 2001

**Interviewee(s): Dr. Sarah Lister
Donald P. Hoppert**

Background and Purpose

On March 22, 2002, representatives of the Ritualistic Uses of Mercury Task Force met with members of American Public Health Association (APHA) in Washington, D.C. The purpose of this meetings was to:

The purpose of this meeting was to:

- Establish new relationships with members of APHA,
- Determine what, if any, knowledge and experience APHA has had with mercury poisonings, and
- Seek feedback on an outreach strategy aimed at reducing mercury exposure in Latino and Caribbean communities.

Results

Mercury-related education efforts undertaken by APHA have almost exclusively dealt with methylmercury exposure, encouraging reduction of mercury into the nation's waterways, advising pregnant women to avoid eating fish that may contain methylmercury, and encouraging the use of alternative mercury-containing consumer and health care products. As a national advocacy group, APHA published its position paper on methylmercury exposures in November 1999; however, the association has not issued any policy statements regarding elemental mercury exposures. APHA has had limited involvement with this issue, consisting mainly of a joint conference held between APHA and the American Academy of Pediatrics, at which the interviewees met with Phillip Ozuah, a researcher in the field of pediatric elemental mercury poisonings and a member of the Task Force. Members of APHA who were interviewed were unaware of any reported incidents of cultural and religious mercury exposures, not did they have any reports regarding mercury exposures in school laboratories.

It was suggested that the Environmental Division of APHA may possess more knowledge of potential mercury exposures through cultural and religious exposure routes. This division deals with issues in environmental justice and harm reduction, and would therefore be a better source of information on this topic. In addition, the environmental division of APHA has previously worked with EPA in regard to issues related to clean air and water standards. Mr. Don Hoppert agreed to solicit information on elemental mercury exposures from this division.

The Task Force expressed interest in seeking the APHA's assistance in developing and possibly conducting outreach strategies to prevent cultural and religious mercury exposures. APHA representatives suggested that should EPA develop an outreach and education strategy; APHA can issue an article summarizing the Agency's stance in its publications "Our Nation's Health," provided there is a definitive issue to address and a clear conduit for doing so.

Recommended Actions

Given the underground nature of cultural and religious uses of mercury, APHA recommended modeling an education and outreach strategy after the HIV/AIDS model. This model proved to be a successful tool for educating the public on an illness that was highly stigmatized in ways that blamed the victims, rather than being viewed as an indiscriminate virus rapidly creating a public health crisis. Due to the sensitivities associated with cultural and religious mercury use, it was also suggested that the Task Force avoid focusing too intently on religious routes of mercury exposure. This is in part due to the limited knowledge regarding the extent of such practices, as well as the level of difficulty involved with tailoring an outreach strategy to such a small community. APHA felt that by piggybacking onto broader mercury programs, such as methylmercury, the Task Force would more effectively address elemental mercury poisonings.

It was suggested that the Task Force should seek the input of cultural anthropologist familiar with cultural practices affecting health care. APHA agreed to contact the National Minority AIDS Council for possible contacts in the field of medical and cultural anthropology.

Recommended Contacts

National Minority AIDS Council
American Academy of Pediatrics
Hispanic Caucus, U.S. House of Representatives

Interview Summary 4 - League of United Latin American Citizens

Date: March 26, 2001

Interviewee (s): Brent A. Wilkes

Background and Purpose

On March 26, 2001, representatives of the Ritualistic Uses of Mercury Task Force met with Mr. Brent Wilkes of the League of United Latin American Citizens (LULAC) in Washington, D.C. The purpose of this meeting was to:

- Establish new relationships with members of LULAC,
- Determine what, if any, knowledge and experience LULAC has had with mercury poisonings, and
- Seek feedback on an outreach strategy aimed at reducing mercury exposure in Latino and Caribbean communities.

Results

Mr. Wilkes was not aware of the cultural and religious practices that use mercury in the Latino community, nor of the toxic effects of elemental mercury exposure. LULAC is aware of alternative means for health care through Latino communities practicing indigenous medicine; however, methodologies that incorporated mercury have not been reported. After briefing Mr. Wilkes on the background and purpose of the Task Force, Peter Redmond expressed the Task Force's desire to seek LULAC's input on communication inlets to Latino populations in this country. Mr. Wilkes inquired as to what sparked interest in this issue. Dr. Donna Riley then explained that attention to elemental mercury began to rise as botanicas in several major cities were found to be selling mercury without any knowledge of its toxicity. Dr. Riley also explained the concern over elemental mercury exposure via inhalation, and its particularly harmful effects in children.

LULAC is largely decentralized, comprised of 800 councils throughout the country. Each council operates autonomously, furthering agendas deemed important to the Latino constituency in that area. Programs instituted by LULAC predominantly deal with education, scholarships, and community networking. Public health issues are not typically addressed by the organization, although councils do assist in education when possible. Health education is largely done through grassroots networking, promoting healthy living. LULAC does advocate issues related to environmental justice in Latino neighborhoods throughout the country as well.

Recommended Actions

Mr. Wilkes offered to run educational pieces regarding elemental mercury exposure through its media channels, Web site, and national publication, *LULAC News*. He was of the opinion that

mercury use was not widespread among LULAC's constituency and that embracing the broader issue of mercury exposure as a whole was the most effective means for educating the public.

Recommended Contacts

National Council of La Raza
National Puerto Rican Association
Cuban American National Council
National Alliance for Hispanic Health

Interview Summary #5 - Pan American Health Organization

Date: March 26, 2001

Interviewee(s): Mauricio Pardon Ojeda

Background and Purpose

On March 26, 2001, representatives of the Ritualistic Uses of Mercury Task Force met with Mr. Mauricio Pardon Ojeda, Director of the Division of Health and Environment of the Pan American Health Organizations (PAHO) in Washington, D.C. The purpose of this meeting was to:

- Establish new relationships with members of PAHO
- Determine what, if any, knowledge and experience PAHO has had with mercury poisonings, and
- Seek feedback on an outreach strategy aimed at reducing mercury exposure in Latino and Caribbean communities.

Results

The PAHO is an international public health agency working to improve health and living standards of the countries of the Americas. It serves as the specialized organization for health of the Inter-American System and also serves as the Regional Office for the Americas of the World Health Organization. The Division of Health and Environment has two programs and one Pan American Center: Basic Sanitation; Environmental Quality; and Pan American Center for Sanitary Engineering and Environmental Sciences. The functions of the Division are to promote, coordinate, and implement technical cooperation activities directed toward diminishing the inequities related to the exposure to environmental risks. Its main focus is on the development of an intersectoral, holistic, and global approach to identify, evaluate, prevent, and control environmental risks for public health, with particular emphasis on the most vulnerable groups.

Before meeting with the Task Force, Mr. Ojeda requested information regarding the incidence of mercury exposure through cultural and religious routes. Among the countries from which this information was solicited were Cuba, Panama, Brazil, Mexico, Peru, and the Dominican Republic. All of the member countries indicated that data on this topic, if they do indeed exist, are limited and difficult to obtain. There was nothing to report at the time of the interview. EPA had contacted PAHO four years earlier in an attempt to locate anyone with knowledge on mercury sales, exposures, and/or poisonings within PAHO member countries. Mr. Ojeda indicated that in America, it may be much easier to obtain mercury in a botanica than for an individual in his or her home country. The reasoning behind this is that mercury is fairly expensive and there would not be a lot of incentive to burn it, as typical in some rituals. The only tangible incidents PAHO has been involved with concerning mercury exposure relate to industrial mercury spills.

Donna Riley and Peter Redmond explained to Mr. Ojeda that the paucity of clinical data regarding mercury exposure, has limited the scope of the Task Force. Given this situation, the Task Force is focusing on the hazards of mercury in general, a strategy that will include information on cultural and religious routes of exposure, but not focus exclusively on that topic.

Recommended Actions

Mr. Ojeda posed the question to EPA on what PAHO could do to assist the Task Force in its mission. Donna Riley stated that PAHO could provide valuable cultural insights into the uses of mercury, including who uses it, in what manner, how much is being used, when its being used, and where it is used. With regard to research, Mr. Ojeda suggested contact the Peru member office in which the Director General of Health and Environment had conducted extensive research on the health effects of mercury spills. Mr. Ojeda also indicated that he would be willing to solicit data from other countries on mercury use, provided the Task Force devise a list of questions on the issue for distribution to the health promotion and cultural representatives within the respective countries. Mr. Ojeda stated that PAHO has access to a vast amount of data and information in the field of medical anthropology, including topics such as folk medicine and spiritual healing. The Division also access to data regarding the incidence of exposure and poisoning to other toxic substances, such as lead tetroxide.

Recommended Contacts

Mr. Ojeda agreed to serve as the liaison between the Task Force and all PAHO countries to solicit data.

Jorge Villena, Director General of Health and Environment, Lima, Peru - jvillena@digesa.sld.pe

Interview Summary # 6 - Temple of Yehwe

Date: April 27, 2001

Interviewee(s): Max Beauvoir, Voodoo Houngan

Background and Purpose

On April 27, 2001, representatives of the Ritualistic Uses of Mercury Task Force met with Mr. Max Beauvoir, a Voodoo Houngan of the Temple of Yehwe in Washington, D.C. The purpose of this meeting was to:

- Establish new relationships with members of Temple,
- Determine what, if any, knowledge and experience Mr. Beauvoir has had with mercury poisonings, and
- Seek feedback on an outreach strategy aimed at reducing mercury exposure in the Caribbean, particularly Haitian, community.

Results

Max Beauvoir has been a practitioner of Voodoo in the Washington, DC, area for many years. He is well-connected and well-known in the Caribbean community, particular among Haitian immigrants. Like many Voodoo priests, Mr. Beauvoir provides his services through his temple, which is located in his home. Mr. Beauvoir explained that the site for many Voodoo rituals is in the practitioner's home, in keeping with religious tradition. The Voodoo community in the Washington Metropolitan area is close-knit, albeit somewhat underground. There appears to be several prominent religious leaders that are unknown to outsiders, yet are venerable figures within the African and Caribbean communities.

With regard to mercury, Mr. Beauvoir explained that it is used during certain practices that he described as "magic." The theory behind mercury's use is that the very physical nature of the metal enhances the spell's effectiveness. In Voodoo, mercury is viewed as a "magical" ingredient because its unusual properties (high surface tension, metal liquid at room temperature, and high density) seemingly defy the laws of nature.

Mr. Beauvoir described the manner in which mercury is often incorporated into Voodoo magic. Mercury is placed in a dish and then covered with oil, after which a candle wick is inserted and lit. Such rituals are performed on an as-needed basis, determined by the client seeking services in consultation with the priest. Mr. Beauvoir noted that typically, the practitioner would do this alone in his temple, and not in the presence of a client. Mr. Beauvoir stated that in 35 years as a practitioner he has never heard of anyone suffering physically from the effects of mercury used during such rituals.

Mr. Beauvoir said that Voodoo is closely linked to other Caribbean religions, such as Espiritismo, the predominant religion in the Dominican Republic. He said that Voodoo is considered to be the supreme religion that encompasses other faiths of African origin or influence such as Espiritismo. Haiti is the central location for the education of Voodoo practitioners, and draws people from around the world to study the religion, including practitioners of other African Diaspora religions such as Santeria. Mr. Beauvoir stated that to practice Voodoo rituals, one must complete the necessary training. When asked about “home rituals” that might be found in a popular book on Voodoo, he stated that they are not permitted unless exercised by an authentic Voodoo practitioner. There is no “do-it-yourself” practice in Voodoo, despite the large number of books marketing the religion in that way. Mr. Beauvoir’s practice emphasizes a holistic approach to Voodoo, one that incorporates self-reliance and self-improvement with rituals. A unilateral reliance on magic is not endorsed nor is it recommended by the Voodoo faith.

Recommended Actions

Mr. Beauvoir stated that despite people’s religious affiliation, they are reasonable and rational beings. As with the threats of lead, once educated on the possible damaging effects of mercury, the individual will stop using it or at least use it in a safer manner. The trick is finding the most effective means for conducting such educational campaigns. Mr. Beauvoir stated that media outlets for Latino and Caribbean communities (TV, radio, and newspaper) would be a good place to deliver mercury safety announcements. As for addressing cultural and religious uses of mercury, he suggested contacting religious leaders in outreach and education, lay persons may be more inclined to heed warnings of the hazards associated with religious mercury use if it comes from a trusted community figure.

When asked about banning the sale of mercury to curb the unsafe use of in religious practices, Mr. Beauvoir felt that this was not only unrealistic, but would be ineffective for two central reasons. First and foremost, Voodoo has been practiced for many years and is firmly embedded in Haitian and other Caribbean cultures. If a practitioner believes in its effectiveness, then a government mandate will do little to convince him or her otherwise. Second, a ban would be ineffective because of the inherent distrust that many believers of Voodoo have for Western society. Voodoo has been made a freakish spectacle by the entertainment industry, often portraying practitioners and believers as bloodthirsty savages eager to wreak havoc on the lives of those who have committed even mild transgression against them. Public scrutiny based on such outlandish accounts have in essence forced the practice of Voodoo underground, and away from regulation imposed government. There is little reason to believe that Voodoo practitioners and followers will be inclined to trust a society that does not completely understand or accept them.

Recommended Contacts

1. African Religious Coalition - Washington, DC
2. Yoruba House - Washington, DC
3. Mother Taylor - Religious leader in Washington, DC
4. Assar Auset Society - Ethiopian organization based in Washington, DC
5. The Akans Group

APPENDIX E: EVALUATING COMMUNITY OUTREACH EFFORTS

Below are a few resources that can assist groups in planning and conducting evaluations.

1. Georgia Tech Evaluation Tools. Available from URL: http://mine1.marc.gatech.edu/MM_Tools/evaluation.html.
2. Taking stock: A Practical Guide to Evaluating Your Own Programs - Horizon Research Group. Available from URL: <Http://www.horizon-research.com/publications/stock.pdf>.
3. University of Kansas Community Toolbox. Part J. Evaluating Community Programs and Initiatives. Available at URL: http://ctb.lsi.ukans.edu/tools/EN/part_1010.htm.
4. Mark Kline, Caron Chess, and Peter M. Sandman. *Evaluating risk communication programs: A catalogue of "quick and easy" feedback methods*. A book length summary and assessment of 22 tools for helping practitioners evaluate risk communication. 1989. Available from Rutgers University Center for Environmental Communication URL: <http://aesop.rutgers.edu/- cec>
5. Neil D. Weinstein and Peter M. Sandman. Some criteria for evaluating risk messages. *Risk Analysis*. 1993;13:103-114.
6. Neil D. Weinstein. What does it mean to understand a risk? Evaluating risk comprehension. *Journal of the National Cancer Institute*. 1999;25:15-20.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

APR 20 2015

OFFICE OF
CHILDREN'S HEALTH PROTECTION

Arnold P. Wendroff, PhD
544 Eight Street
Brooklyn, NY 11215-4201

Dear Dr. Wendroff,

This is in response to your electronic mail message of March 27, 2015. Thank you for your continued interest and efforts to protect children's health. The Environmental Protection Agency (EPA), in both Region 2 and in Washington, DC has acknowledged your correspondence about "Caribbean and Latino children who are continually exposed to mercury vapor emanating from 'historic' magico-religious mercury spills in their homes." Please know our efforts to protect children from all sources of harmful environmental exposures are ongoing and critical to our mission to ensure children have safe environments to live, learn, and play. Addressing mercury exposures that adversely impact children's health, from all sources, including ritual uses, will continue to be a part of our efforts.

In an effort to address the use of elemental mercury as part of certain spiritual practices and folk traditions, in 2002, EPA led an interagency task force to address ritualistic use of mercury. By establishing the multi-agency task force, EPA hoped to gain a better understanding of these practices and traditions and their potential public health and environmental impacts.

The work of the task force concluded with several recommendations, the most relevant ones to your concerns include: 1) providing communities with resources to protect children from exposures to mercury; 2) research and environmental monitoring; and 3) identifying steps to be taken by local public health agencies to address the ritual use of mercury (i.e., methods for identifying and engaging susceptible populations, building partnerships with leaders within those populations, and working with the leaders to give joint messages).

The resulting EPA actions included:

- 1) A parental focused pamphlet, "Protect your Family from Mercury in your Home", addressing the use of mercury in a folk remedy or spiritual practice.
- 2) EPA provided funds for a report by the National Association of City and County Health Officials. The report suggested steps to be taken by local public health agencies to address the ritual use of mercury, including methods for identifying and engaging susceptible populations, building partnerships with leaders within those populations, and working with community leaders to give joint messages.
- 3) EPA provided funds for surveys and focus groups about the ritual use of mercury among Latino residents in Lawrence, Massachusetts. This also includes indoor air testing of homes and botanicas.
- 4) The ritual use of mercury was incorporated into the Toxicity and Exposure Assessment for Children's Health (TEACH) chemical summary for mercury, http://www.epa.gov/teach/chem_summ/mercury_elem_summary.pdf and is also addressed on EPA's website at: <http://www.epa.gov/mercury/whereyoulive.htm>.

- 5) EPA's Region 5 Children's Health Program has included elemental mercury in healthy homes training for healthy housing, social and community service providers in communities where there is some indication that mercury is being used in ritual practices.

In a 2006 a report was issued from the Office of the Inspector General (OIG) entitled "EPA Is Properly Addressing the Risks of Using Mercury in Rituals." The report concluded that EPA has addressed the health risks posed by the ritual use of mercury and that EPA's education and outreach is important and should be continued because, although the ritual use of mercury may be a minor source with regard to the overall use in the general population, the vapors resulting from ritual uses can produce highly elevated mercury levels.

With regard to our work on other forms of mercury, in 2011, EPA finalized rules to reduce mercury emissions from power plants, which will contribute primarily to decreasing methylmercury exposure in childhood and across all lifestages. The primary route of human exposure to methylmercury is fish consumption, and to further reduce the public health risks, EPA is working with the Food and Drug Administration (FDA) to update our joint advisory on fish consumption. We will continue to work with FDA and other federal partners, such as the Agency for Toxic Substances and Disease Registry, to educate the public about the dangers of exposure to all types of mercury. Separate outreach and education around EPA's guidance on cleaning up broken compact fluorescent lightbulbs has also further helped reduce exposure to mercury in the built environment.

EPA will continue to monitor, research, and address mercury exposures, including ritualistic uses of mercury, in the most appropriate manner possible.

Thank you for all of the hard work you have contributed to this issue. Your efforts have assisted in bringing more visibility and awareness to this problem.

Sincerely,



Ruth A. Etzel, MD, PhD
Director



United States
Environmental Protection Agency
Washington, DC 20460

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RECD.
05.01.15



FERNANDO FERRER
BOROUGH PRESIDENT

OFFICE OF THE BRONX BOROUGH PRESIDENT

The Bronx County Building
851 Grand Concourse
Bronx, New York 10451
590-3500



April 7, 2000

Antonia Novello, M.D.
Commissioner
New York State Department of Health
Corning Tower
Empire State Plaza
Albany, NY 12237

Dear Commissioner Novello:

It has been brought to my attention that the sale of unlabeled elemental mercury continues to take place in New York City, despite previous publicity of this problem. People who purchase mercury, a legal substance that is sometimes improperly labeled, often use the substance in ways that put their health at risk.

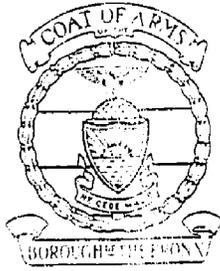
In light of the known health-related dangers of mercury, I urge the State to conduct a public outreach and education campaign on the toxic effects of elemental mercury and to enforce the sale of improperly labeled mercury.

The Department of Health's primary mission is the prevention of illnesses. I ask that you incorporate the issue of mercury poisoning into carrying out your missions.

Sincerely,

FERNANDO FERRER

BPB9194
FF/mn



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FERNANDO FERRER
BOROUGH PRESIDENT

July 23, 1997

Benjamin Mojica, MD, MPH
Acting Commissioner of Health
New York City Department of Health
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New York, NY 10013

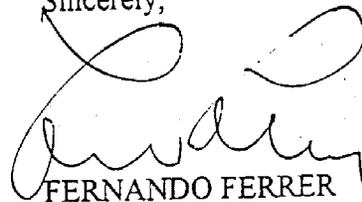
Dear Commissioner Mojica:

It has recently been brought to my attention that the sale of unlabeled elemental mercury is still ongoing in New York City. I understand that in the past the New York City Department of Health (NYCDOH) has taken steps to raise public awareness on this issue and to educate communities across the City about the dangers associated with this hazardous chemical.

In light of the recent warnings issued by the Agency for Toxic Substances and Disease Registry (ATSDR) and the Environmental Protection Agency (EPA), I urge the NYCDOH to once again conduct a public outreach and education campaign on the toxic effects of elemental mercury, particularly for pregnant women and children. As reported last year in the American Journal of Public Health, it is quite easy to purchase mercury in New York City. Purchasers, however, should be made aware of the risks involved and your role in raising public awareness is important.

I also understand that you will be meeting with the EPA and the New York State Department of Health to further discuss this issue. I would appreciate being kept informed of your continued efforts in this area.

Sincerely,



FERNANDO FERRER

BHSDC #7116

Comparison of Indoor Mercury Vapor in Common Areas of Residential Buildings with Outdoor Levels in a Community Where Mercury Is Used for Cultural Purposes

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Elemental mercury has been imbued with magical properties for millennia, and various cultures use elemental mercury in a variety of superstitious and cultural practices, raising health concerns for users and residents in buildings where it is used. As a first step in assessing this phenomenon, we compared mercury vapor concentration in common areas of residential buildings versus outdoor air, in two New Jersey cities where mercury is available and is used in cultural practices. We measured mercury using a portable atomic absorption spectrometer capable of quantitative measurement from 2 ng/m³ mercury vapor. We evaluated the interior hallways in 34 multifamily buildings and the vestibule in an additional 33 buildings. Outdoor mercury vapor averaged 5 ng/m³; indoor mercury was significantly higher (mean 25 ng/m³; $p < 0.001$); 21% of buildings had mean mercury vapor concentration in hallways that exceeded the 95th percentile of outdoor mercury vapor concentration (17 ng/m³), whereas 35% of buildings had a maximum mercury vapor concentration that exceeded the 95th percentile of outdoor mercury concentration. The highest indoor average mercury vapor concentration was 299 ng/m³, and the maximum point concentration was 2,022 ng/m³. In some instances, we were able to locate the source, but we could not specifically attribute the elevated levels of mercury vapor to cultural use or other specific mercury releases. However, these findings provide sufficient evidence of indoor mercury source(s) to warrant further investigation. **Key words:** cultural use of mercury, elemental mercury, indoor air quality, mercury, mercury exposure, mercury vapor, Santeria, voodoo. *Environ Health Perspect* 114:59–62 (2006). doi:10.1289/ehp.8410 available via <http://dx.doi.org/> [Online 20 September 2005]

Mercury is one of two elements that are liquid at ambient temperature. It is 13 times heavier than water, and its unique properties have led to a wide variety of uses in industry and elsewhere. Elemental mercury is still widely used in dentistry and a variety of hospital applications (Haas et al. 2003). It is also found in a number of technologic applications such as thermometers, barometers, thermostats, switches, gas meters, and especially fluorescent lights that may be found in residential buildings. In the past, organic mercury compounds were widely used as preservatives in household paints, and mercury antiseptics are still in use.

The unique properties of elemental mercury or quicksilver have led people to attribute magical and spiritual powers to it through the ages. Mercury was viewed as an essential component of the alchemical triad of mercury, sulfur, and air and has been associated with the Hindu god Shiva (Little 1997). Mercury amalgam religious icons remain available today (Garetano G, unpublished data). Elemental mercury is also used in the spiritual practices associated with Santeria, voodoo, Espiritismo, Palo Mayumbo, and other Afro-Caribbean syncretic religions [Riley et al. 2001; U.S. Environmental Protection Agency (EPA) 2002]. Additional

uses of elemental mercury in a superstitious manner have been reported (Wendroff 1990). These practices include sprinkling elemental mercury in the home, in cars, or around babies and carrying capsules of mercury as amulets to bring good luck or love (Johnson 1999; U.S. EPA 2002). These activities do not appear to be components of ceremonial use associated with spiritual traditions, nor are they condoned or recommended by serious practitioners of those traditions (Stern et al. 2003). We label these uses of mercury, separate from the ceremonial use in spiritual traditions, as cultural uses. In communities where cultural uses of mercury are believed to be prevalent, the availability of mercury in specialty shops called botanicas has been well documented (Riley et al. 2001; Wendroff 1990; Zayas and Ozuah 1996).

Both the technologic applications and cultural uses of mercury provide the opportunity for it to be an indoor air pollutant in residential settings. Elemental mercury evaporates at a rate of 7 µg/cm²/hr at 20°C (Andren and Nriagu 1979). Up to 80% of inhaled mercury is absorbed and readily crosses the blood–brain barrier (Cherian et al. 1978; Clarkson 2002). The primary health concern associated with inhaled mercury vapor is its neurotoxicity, and infants are considered particularly

vulnerable. The Agency for Toxic Substances and Disease Registry (ATSDR) and the U.S. EPA, respectively, have established a minimal risk level (MRL) of 300 ng/m³ and a reference concentration (RfC) of 200 ng/m³ for elemental mercury vapor in residential quarters (ATSDR 1999; U.S. EPA 1995). The release of elemental mercury in a household may pose some health risk for those who are exposed. For example, broken clinical thermometers typically contain only 600–675 mg elemental mercury but can generate mercury vapor concentrations an order of magnitude above both the U.S. EPA RfC and the ATSDR MRL (Carpi and Chen 2001; Muhlendahl 1990; Riley et al. 2001; Smart 1986). Health effects in children have been documented from such exposures (Moreno-Ramírez et al. 2004).

By comparison, elemental mercury for cultural use is commonly distributed in gelatin capsules containing approximately 9 g elemental mercury (Riley et al. 2001; Wendroff 1990), which, when released, can result in high concentrations of vapor (Riley et al. 2001; U.S. EPA 1993). At least one case of significant human exposure to elemental mercury requiring medical intervention as a result of cultural practices has been reported (Forman et al. 2000).

Once spilled, sprinkled, or left in an open container, elemental mercury may release vapor for prolonged periods. Significant levels of mercury vapor have been found in buildings decades after spillage, resulting in the significant exposure of subsequent building

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occupants without their knowledge (Centers for Disease Control and Prevention 1996; Orloff et al. 1997).

Other than those investigations conducted in response to known spills, data regarding mercury vapor concentration in residential buildings are scant. Carpi and Chen (2001) surveyed 12 residential and commercial sites in the New York metropolitan area without prior knowledge of mercury contamination. Eleven of these locations were found to have mercury vapor concentrations significantly elevated over outdoor concentrations. Prior breakage of clinical fever thermometers was subsequently identified as the probable mercury source in two of the locations.

Given the lack of documentation of mercury vapor in residential buildings in general or of a disproportionate elevation of mercury vapor in buildings in communities where it is used culturally, we chose to conduct a survey of residential dwellings in a community in which elemental mercury is readily available to assess the prevalence of mercury use or spillage.

We hypothesized that elevated levels of mercury vapor would be found in residential buildings in communities that engage in cultural uses of mercury. We further hypothesized that these elevated levels can serve as a signal of significant cultural use in addition to unintentional breakage and spillage from other sources. In this article we address the first hypothesis. We address the second hypothesis in a subsequent study to be published separately.

Materials and Methods

Rationale for this study design. Riley et al. (2001) described a high level of apprehension and distrust of authorities or any outsider from a different culture. As a result of these cultural barriers, direct investigation of the residences of persons possibly using mercury for cultural purposes without first establishing a cause for concern was deemed inappropriate. Therefore, as a first step in characterizing the extent of this phenomenon, we chose to monitor mercury vapor within interior hallways of residential buildings, rather than directly measuring mercury vapor in residences, under the assumption that intentional and unintentional releases of mercury within the building would be reflected in elevated concentrations in common areas compared with the respective outdoor concentrations. Measurement of mercury vapor in common areas does not provide a direct estimate of exposure, but by comparing these measurements with respective outdoor levels and by comparing measurements across buildings, we can assess the prevalence of elevated indoor mercury concentrations. This information can

inform decisions about appropriate public health strategies and can guide future surveys.

Site selection. The information on cultural uses of mercury suggests that such uses are most common among certain Latino-Caribbean populations. The geographic area selected for inquiry was based on our prior knowledge of both the predominant Latino population and the presence of botanicas that typically sell mercury (Riley et al. 2001; Stern et al. 2003). The study was conducted in the New Jersey municipalities of Union City and West New York, comprising a total area of approximately 2.4 mi² (6.2 km²), with 82.3 and 78.7% Latino population, respectively. Multifamily buildings were chosen for accessibility of common areas as well as for the potential for efficient screening. A primary criterion was that the buildings surveyed be within 0.5 miles (0.8 km) of a botanica. On the initial sampling date, a building meeting this criterion was selected on referral from a local health official, and all accessible buildings for approximately a two-block radius were evaluated. On subsequent sampling dates the same procedure was followed in other areas of the community meeting the same criteria. Additionally, three botanicas and one former botanica encountered during the residential building surveys were also visited.

Mercury vapor monitoring. We measured real-time mercury vapor concentration in air using an atomic absorption spectrometer (model 915+; Ohio Lumex Co. Inc., Twinsburg, OH). The instrument has a sensitivity of 2 ng/m³ of mercury in air and has been successfully used for measuring mercury in ambient air (Ohio Lumex 2000; Zdravko and Mashyanov 2000). In previous studies, residential structures identified as having elevated mercury concentration with such direct reading instruments were also found to have elevated mercury vapor concentration with 8-hr sampling and subsequent laboratory analysis (Singhvi et al. 2001).

The instrument was factory calibrated according to the manufacturer's specification and was within its factory calibration schedule. The spectrometer warmup, operation, and calibration followed the manufacturer's instructions. Internal calibration uses a built-in mercury cell and was performed in the field before and on completion of sampling in typical field conditions. During internal calibration, measured mercury concentration varied from the predicted concentration by < 10% on each date. We validated precision by evaluating the relative deviation of triplicate measurements at each sampling location. The overall relative deviation for the 286 triplicate sample sets that were equal to or exceeding the manufacturers' stated detection limit of 2 ng/m³ mercury vapor was 7.9%.

Once the instrument was warmed up and calibrated, it was operated continuously. All measurements were recorded at a height of approximately 1 m above the floor unless otherwise indicated. Each data point is the average of three discrete 10-sec measurements at a given sampling location. The instrument also displayed mercury concentration continuously in a real-time sampling mode. This allowed evaluation of spatial variation and trends in mercury vapor concentration. Potential sources were localized where possible.

Site visits were conducted on 6 days in June and August 2002. Although only one visit was planned for each site, repeat visits were made to two buildings because of the high mercury vapor concentration encountered. Mercury vapor was monitored in the vestibule and the interior hallways on each floor of the buildings. These interior hallways contain the entrances to residential apartments. About half the buildings surveyed had open access to both locations. A total of 227 locations in 67 buildings were surveyed. On average, five hallway locations were assessed in those buildings that were fully accessible. All buildings were visited once except the two buildings with the highest readings. Mercury vapor measurements were recorded in 37 outdoor locations in proximity to the buildings evaluated. Outdoor readings near neighboring buildings showed low variation. Within the three botanicas and one former botanica, mercury vapor was monitored in the retail portion of the store.

Additional data. In addition to mercury vapor measurements, the following data were also collected for each building: number of residential units, number of floors, presence of a central heating ventilation and air conditioning system (HVAC), and the presence of open windows.

Data analysis. We calculated the mean mercury vapor concentration for each floor of a building by averaging all data points for that floor. We computed the average mercury concentration for a building by averaging the mean concentration for each floor. The maximum mercury vapor concentration reported for a building is the maximum data point from any hallway location within the building. Statistical analysis was conducted using SPSS software (SPSS Inc., Chicago, IL). Specific tests are indicated in the results section as applicable.

Results

Site access and characteristics. Sixty-seven buildings were visited, of which approximately half were fully accessible. Only vestibules were accessible in the remainder. All buildings in which the interior halls were accessed ($n = 34$) were multistory (mean, 4 floors) with a total of 497 residential units

(mean, 14 units). Buildings in which only the vestibule was accessible tended to be slightly smaller (mean, 12 units), although this difference was not significant ($p = 0.18$). Based on familiarity with the area, including community history, overall appearance, and census characteristics, all buildings are believed to be > 50 years old, although records were not uniformly available. None of the buildings had HVAC systems that influenced the areas evaluated. Ventilation within the hallways was primarily influenced by windows and doors to residential apartments; 12 of 34 (35%) buildings had open hallway windows during the time of the visit.

Mercury vapor concentration. The data were log-normally distributed; thus, arithmetic and geometric mean values, as well as percentiles, are reported. Because of relatively limited sample size and non-normal distributions, we compared mercury values using the Mann-Whitney U -test as well as by t -test on log-transformed data, unless otherwise indicated.

Outdoor mercury vapor concentrations had a mean value of 5 ng/m³ with an 80th percentile of 12 ng/m³ and a 95th percentile of 17 ng/m³. Our findings are consistent with outdoor levels measured elsewhere ranging from several nanograms per cubic meter to 20 ng/m³, with higher concentrations associated with urban/industrial areas and ambient mercury outside a mercury storage facility in Hillsborough, New Jersey, ranging from 2 to 8 ng/m³ (ATSDR 1999; Gochfeld M, unpublished data; New Jersey Department of Environmental Protection 2001).

The geometric and arithmetic mean mercury concentrations in building hallways were 10 ng/m³ and 25 ng/m³, respectively. In building vestibules, the geometric and arithmetic means were 7 ng/m³ and 11 ng/m³, respectively. The mercury vapor concentration in interior hallways was significantly greater than that found outdoors ($p < 0.001$) and in building vestibules ($p < 0.05$). Mercury vapor in vestibules was also greater than that found outdoors ($p < 0.001$). All three locations were found to differ significantly ($p < 0.001$) when compared simultaneously using the Kruskal-Wallis nonparametric one-way analysis of variance test. Indoor and outdoor mercury vapor concentrations are summarized in Tables 1 and 2.

We found that 7 of 34 (21%) buildings had a mean mercury vapor concentration in hallways that exceeded the upper 95th percentile of outdoor mercury vapor concentration (17 ng/m³), and that 35% of buildings (12 of 34) had maximum mercury vapor concentration in hallways that exceeded the upper 95th percentile of outdoor mercury vapor concentration.

No significant difference was noted in the mean and maximum mercury vapor

concentration in buildings that had open windows compared with those that had either no windows or closed windows ($p < 0.8$ and $p < 0.4$, respectively). No difference was noted between mercury vapor concentration by measurement date using Kruskal-Wallis Test ($p > 0.6$) nor among the floors of the building on which the maximum concentration of mercury was detected ($p > 0.7$).

Within the three botanicas surveyed, average mercury concentration ranged from 40 ng/m³ to 482 ng/m³ (mean, 220 ng/m³), whereas a former botanica averaged 72 ng/m³. Mercury concentration within the botanicas was significantly greater than that within the residential buildings ($p < 0.01$).

Spatial variability. We were able to localize potential sources of mercury contamination in seven buildings as evidenced by increasing mercury concentration as the "source area" was approached. At two sites, the probable source of mercury vapor emission was tracked to areas on the floor surface, one near a building entrance, the second on a stairway to a roof exit. In the remaining five buildings, mercury vapor concentration increased as certain individual or groups of apartment entrances were approached. No visible contamination was noted in any of the cases, and the actual source of vapor remained unknown.

We noted order of magnitude differences in mercury concentration between locations in buildings with high mercury concentration. For example, mercury vapor concentration ranged from 35 ng/m³ to 2,022 ng/m³ in the building with the highest concentration. Similar findings were noted elsewhere. The difference between mercury concentration on the building level (floor) on which the maximal value was noted and the remainder of the building was significantly higher in four of the buildings ($p < 0.04$).

Temporal variability. Although our intent was to survey buildings once, two buildings had maximum hallway mercury vapor concentrations of 2,022 ng/m³ and 774 ng/m³, which exceeded both the ATSDR MRL (300 ng/m³) and U.S. EPA RfC (200 ng/m³).

Local public health officials were notified, and repeat visits were made to each building. The building with the highest concentration was visited on five dates. Both the average and maximum mercury vapor concentrations of the building were significantly different on repeat visits (Kruskal-Wallis test, $p < 0.04$). Outdoor temperature ranged from 17 to 31°C, and hallway windows were open, providing passive ventilation, on all dates. The building hallways were not cooled, and indoor temperature was similar to that outdoors. Unexpectedly, mercury vapor concentration did not vary as a result of temperature changes ($p > 0.7$), and contrary to expectation, higher mercury vapor concentrations were noted on cooler days. By the final visit, maximum mercury vapor concentrations in each building (109 and 19 ng/m³, respectively) were significantly reduced ($p < 0.01$) compared with the initial visit. In both buildings, mean and maximum mercury concentrations fell below MRL and RfC. Despite the reduction in vapor concentration, the area of maximum concentration remained consistent.

Discussion

Our findings provide a valuable first look at the differences between indoor mercury concentrations and those outdoors in an area with known cultural use of mercury. Although our data are not intended as estimates of residential exposure to mercury vapor, they do indicate that, compared with outdoor levels, such exposures are likely in a significant proportion of multifamily residential buildings in an area with known cultural uses of mercury. This study did not include comparison with indoor mercury concentrations in a comparable area that can serve as a control for cultural use of mercury. Therefore, these data cannot distinguish between those elevations in mercury concentration resulting from cultural uses and those resulting from unintentional releases of mercury (e.g., broken thermometers or fluorescent lightbulbs, spilled gas meter seals). We are currently engaged in a follow-up study to investigate these questions.

Table 1. Comparison of mercury vapor concentration (ng/m³) within building hallways and outdoors.

Location	No.	Arithmetic mean \pm SD	Geometric mean (SD)
Outdoors	37	5 \pm 5	4 (2)
Building vestibule	57	11 \pm 12	7 (2)
Mean in building hallways	34	25 \pm 53	10 (4)
Maximum in building hallways	34	102 \pm 364	17 (4)

Mann-Whitney U -test, $p < 0.001$.

Table 2. Distribution of mercury vapor concentration (ng/m³) within building hallways and outdoors.

Location	Percentile				
	25th	50th	75th	90th	95th
Outdoors	3	4	6	12	17
Building vestibules	4	7	13	22	36
Mean of building hallways	6	11	16	66	155
Maximum within hallways	9	14	25	106	1,086

There are relatively few reports of “background” mercury concentration in indoor air in residential buildings or “noncontaminated” environments to which our results can be compared. Our finding of mercury vapor in greater concentrations indoors compared with outdoors is consistent with the findings of Carpi and Chen (2001), who investigated mercury in residences without prior knowledge of mercury use or release.

Carpi and Chen (2001), using a direct reading instrument, were able to identify specific points inside several of the apartments they investigated that appeared to be the source of mercury emissions. Likewise, we were able to localize potential mercury sources in several buildings with elevated mercury concentrations. We clearly observed an increasing gradient in mercury vapor concentration as a potential source was approached. Although the exact source was not identified, the potential source of mercury vapor seemed to be residential apartments in five of the buildings with elevated mercury vapor concentration. Our finding that > 20% of buildings we studied had average and 35% had maximum mercury vapor concentrations that exceed the 95th percentile of outdoor concentrations is significant and leads to the conclusion that sources of contamination are present and prevalent indoors in this community. These findings are consistent with the hypothesis of cultural use of mercury, but not definitive. The elevated mercury vapor concentration found in botanicas is also consistent with its availability for cultural use.

These measurements were not made in areas that directly reflect exposure, nor, for the most part, do they measure concentration at the emission source. Therefore, these measurements could underestimate mercury concentration at the point of long-term exposure. Our surveys were subject to the variability in environmental conditions that occurs in occupied residential buildings and possibly the variability in patterns and methods of cultural mercury use. In most buildings surveyed, including those with the highest mercury vapor concentration, windows were open. This may partially explain the variability in mercury concentration and the lack of association with temperature we found in the sites with repeated visits. Although spot measurements of mercury vapor concentration in buildings may not reflect long-term average mercury concentration, we believe that the

signals of elevated mercury concentration provided by spot measurements are relevant as a screening tool in identifying the presence of mercury release regardless of its source. For this approach to be more effective as a tool for screening for exposures of concern, models need to be developed that can reasonably predict the transit of mercury vapor from a source “behind closed doors” to other rooms or areas of a building under conditions that simulate occupancy.

Whether exposure to elevated mercury vapor arises from intentional cultural uses or from unintentional breakage and spillage of mercury-containing equipment, these exposures pose the potential for adverse health effects and should be addressed. However, the nature and scope of the public health problem will be significantly different for each of these cases. Each will require a different public health outreach and intervention strategy. It is therefore essential that future investigations clarify the relative contribution of each cause. We are currently continuing research to this end.

Given the findings of Carpi and Chen (2001) and this investigation, we feel some broader evaluations to establish reference ranges of mercury concentrations in the indoor residential environment are warranted. Such a reference range would include mercury contamination resulting from historical accidental breakage of mercury-containing equipment. Such contamination may be widespread and would likely be independent of cultural factors. Based on reports on the manner in which mercury may be used for cultural purposes, and our present findings, we also recommend expanded screenings in areas where mercury may be used for cultural purposes with the inclusion of suitable control locations. Although cultural obstacles may be present that may impede a direct approach to assessing human exposure to mercury vapor as a result of cultural practices and its relevance to public health, we believe further evaluations in the field will ultimately shed light on this elusive issue.

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Mercury vapor in residential building common areas in communities where mercury is used for cultural purposes versus a reference community

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ABSTRACT

Background: Exposure to elemental mercury (Hg^0) in residential buildings can occur from accidental spills, broken objects (thermometers, fluorescent fixtures, thermostats), and deliberate introduction, one mode of which involves cultural practices by individuals who believe dispersal of mercury in a residence will bring luck, enhance health or ward off harm. **Objectives:** To determine whether mercury vapor levels in common areas of residential buildings is higher in a community where cultural uses are likely (study areas S1, S2) than in a reference community (C1) where cultural use is unlikely, and whether levels can serve as a signal of significant cultural mercury use.

Methods: We monitored Hg^0 vapor with a portable spectrophotometer in the three communities. We randomly selected sites in S1 and C1 community, and also include sites in S2 specified by local health officials who suspected cultural mercury use. We evaluated 122 multifamily buildings and 116 outdoor locations.

Findings: We found $>25 \text{ ng/m}^3 \text{ Hg}^0$ in 14% of buildings in study areas compared to only one reference building. In the latter we identified an accidental mercury spill from a bottle that had been brought into the building. Both the mean and maximum indoor mercury vapor levels were greater in the study communities than in the reference community. In all communities, we observed mean indoor Hg^0 vapor concentration greater than outdoors, although in two-thirds of buildings, indoor levels did not exceed the area-specific outdoor upper-limit concentration.

Conclusion: After controlling for factors that might influence Hg^0 vapor levels, the most plausible explanation for greater Hg^0 levels in the study area is a relationship to cultural use of mercury. None of the measured levels exceeded the ATSDR minimum risk level for residences of $200 \text{ ng/m}^3 \text{ Hg}^0$ although levels in living quarters might be greater than those in the common areas.

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Abbreviations: C, centigrade; ca., circa; CI, confidence interval; cm^2 , square centimeter; Hg^0 , elemental mercury; km, kilometer; m^3 , cubic meter; mg, milligram; n, number; ng, nanogram; SD, standard deviation; μg , microgram.

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1. Introduction

Elemental mercury (Hg^0) is unique among the elements due to its physical attributes as well as the magical and spiritual attributes that humankind has bestowed upon it for millennia. South Asian and Chinese cultures viewed Hg^0 with reverence for thousands of years and it was essential to the alchemists. Today, icons formed with *parad*, a mercury amalgam, are available and said to bestow peace and prosperity (Astrohastra, 2007).

Hg^0 use in the United States (U.S.) is associated with Afro-Caribbean traditions such as Palo Mayumbe, Santeria, and Voodoo as well as with certain cultural uses (e.g., sprinkling mercury in cars, candles or cradles has been reported (Johnson, 1999; Johnson, 2004; Ozuah et al., 2003; Riley et al., 2001, 2006; Stern et al., 2003; U.S. EPA, 2002; Wendroff, 1990; Zayas and Ozuah, 1996). In urban areas with a Caribbean population, mercury is widely available in stores called “botanicas”. In the Dominican Republic we purchased several grams of Hg^0 in a botanica and were instructed to spread mercury on the floor within the home and the most auspicious days to do so. Wendroff (2005) and Quintero-Somains and Quirindongo (2004) contend mercury contamination of homes may be widespread in communities where Hg^0 is used in religious or cultural practices. However, we believe it is important to differentiate Hg^0 use during ceremonies or the formal practices conducted by initiates, santeros, or priests with those of “laypersons” who may disperse Hg^0 .

Trained practitioners report ceremonial practices do not involve dispersal of mercury but others may use it in accordance with folk traditions or more casual practices that involve dispersal of mercury within a residence (Lythcott, 2003; Riley et al., 2006; Riley et al., 2001; Stern et al., 2003; U.S. EPA, 2002). Practitioners within the Afro-Caribbean traditions have a vested interest in retaining control of rituals, recognize the hazards of mercury, do not condone its use by “laypersons”, and in some cases have initiated actions within their community to curtail inappropriate Hg^0 use (Lythcott, 2003; Riley et al., 2006).

To date, the extent of cultural mercury use has been indirectly assessed by interview and assessment of the availability of mercury in botanicas (Johnson, 1999, 2004; Ozuah et al., 2003; Riley et al., 2001; Stern et al., 2003; U.S. EPA, 2002; Wendroff, 1990; Zayas and Ozuah, 1996). Cultural use of mercury may present an insidious source of exposure in households. A recent survey in New England found a large number of individuals knowledgeable of Hg^0 uses in the home, including sprinkling Hg^0 in a child’s bed or infant’s crib (JSI Center for Environmental Studies, 2003). In Washington D.C., officials conducting screenings of individuals exposed to Hg^0 from a spill in a school laboratory found the highest blood mercury levels in individuals who also used it culturally (Goldstein, 2003).

Although the magnitude of exposure to Hg^0 vapor from cultural use is unknown, the hazard of Hg^0 vapor is well established. Hg^0 released in a home could present a persistent hazard. Mercury vapor is detectable years after small spills as from a broken fever thermometer (Carpi and Chen, 2001; von Muhlen Dahl, 1990). With larger spills, significant concentrations of Hg^0 vapor may persist for decades (Sasso et al., 1996).

We chose to monitor mercury vapor within interior hallways of residential buildings rather than in individual apartments, because of the difficulty in gaining access due to the consistent reports of distrust of outsiders in communities that may use Hg^0 culturally (Lythcott, 2003; Riley et al., 2001; U.S. EPA, 2002). We previously measured Hg^0 vapor levels in the common areas of residential buildings in a community where cultural mercury use exists and found indoor concentrations significantly greater than outdoors (Garetano et al., 2006). In an attempt to determine whether mercury vapor in common areas of residential buildings can serve as a signal of significant cultural use in addition to spillage from other sources, we have revisited the community previously studied, conducted additional sampling and compared our findings with a reference community. Also, at the request of public health officials concerned about cultural Hg^0 use, we monitored Hg^0 vapor levels in multifamily residential buildings in another community (S2). Although these additional buildings were targeted rather than randomly selected, we include these findings, as they are relevant to our inquiry. We also consider building and environmental factors that that might influence Hg^0 vapor levels.

We hypothesize that cultural use of mercury in apartments could lead to elevated Hg^0 vapor levels in the common areas of residential buildings, and that conversely, elevated levels in common areas would signal that cultural mercury use may be occurring. Our measurement of Hg^0 vapor in common areas does not provide a direct estimate of exposure, but allows us to identify signals of Hg^0 release and determine whether these are more prevalent in communities that may use Hg^0 culturally.

We believe this approach can provide useful information regarding the need to initiate specific public health activities, such as education and outreach, regarding cultural mercury use as well as for further study. These elevations are identifiable with sensitive monitoring devices and serve as signals of Hg^0 release whether recent or in the past. Nonetheless, because of the indirect nature of sampling common areas, the absence of elevated levels in common areas, does not mean the absence of cultural uses of mercury. We tested the null hypothesis that there would be no difference in mercury levels between study and reference communities.

2. Materials and methods

The proposal was reviewed by the Robert Wood Johnson Medical School Institutional Review Board (IRB) and approved as exempt, because no individual identifier information was obtained.

2.1. Site selection

Based on our prior investigation and the documented availability of Hg^0 for cultural purposes, we selected two contiguous municipalities in northern New Jersey as our study community (S1) (Garetano et al., 2006; Riley et al., 2001; Stern et al., 2003). During the course of our research, local public health officials in Rockland County, New York, approximately 32 km north of S1, requested our assistance in monitoring Hg^0

vapor in selected buildings. Though not in our initial design, we consider it a secondary study community (S2).

We selected a reference study community (C1) located approximately 16 km to the west of S1. It was selected from among sixty-one communities in a three county area in northern New Jersey. We based our selection on the presence of multifamily housing characteristics similar to those in the study community (S1) but a low likelihood of cultural mercury use, based on demographics and the absence of botanicas that might provide mercury for cultural use.

To control for historic contamination, we determined that multifamily buildings in the study (S1) and reference (C1) communities were of similar vintage and had similar characteristics. For each area, we utilized data from U.S. Census 2000 to identify the percentage of the population of ethnicity or a country of origin among those in which cultural mercury use is reported. We identified the percentage of the population of Hispanic/Latino, West Indian or Asian Indian origin for this purpose (Table 1).

We used the presence of botanicas within a community as an indicator of the likely use of mercury for cultural purposes. Greater than twenty botanicas were identified in S1 and the use or sale of mercury by staff was previously documented (Riley et al., 2006; Riley et al., 2001; Stern et al., 2003). In the course of our earlier investigation, we found approximately two dozen stores that contained “botanica” in their name listed in an online telephone directory. We found no similar listings for botanicas in C1, the reference community, or contiguous towns. We also visited shopping districts in C1 and contiguous towns and found no botanicas. The health officials we interviewed in C1 were not aware of botanicas, the availability of mercury elsewhere, or its cultural use in this community.

In both C1 and S1, we identified multifamily buildings listed in county tax records as a residential apartment building, at least three stories high, with seven or more

residential units. Based on our prior investigation, we determined this building configuration typically contained accessible common areas that adjoin entrances to residential units (Garetano et al., 2006). 672 buildings met these criteria in S1 while 49 met the criteria in C1.

We used data from our initial investigation to determine sample size. Consistent with our prior findings, we assumed 30% of buildings in the study area (S1) would have maximum interior Hg vapor concentrations exceeding outdoor upper limits and the prevalence of such findings in the reference community (C1) would be low, approximately 5%. Using these estimates, we determined a sample size of sixty buildings in the study area and forty buildings in the reference community would provide adequate power to control of the probability of Type I and Type II error ($\alpha=0.05$, $1-\beta=0.84$).

In each community (S1 and C1), we randomly selected buildings from the pool of multifamily buildings that met our criteria. We utilized a random number list and selected buildings for evaluation in the order in which a tax record identifier (block number) matched the random number list. We over-sampled in the study community due to the greater number of buildings to increase the precision of our estimate for that area. We were able to access the interior common areas throughout each of 101 buildings. We evaluated 62 buildings in S1 and 39 buildings in C1. The buildings in S1 did not duplicate those assessed in our earlier investigation (Garetano et al., 2006). In the secondary study community (S2), we evaluated a targeted non-random sample of 21 buildings identified by public health officials.

2.2. Mercury vapor monitoring

We directly measured Hg⁰ vapor in air using a portable atomic absorption spectrophotometer with Zeeman background correction (model 915+, Ohio Lumex Co. Inc. Twinsburg, OH) operated according to the manufacturer’s instructions. Direct measurement of Hg⁰ vapor with this instrument is accurate compared with sampling and analysis by laboratory methods and the instrument is suitable for characterizing ambient Hg⁰ vapor levels in real time with a detection level of 2 ng/m³ (Baker et al., 2005; Garetano et al., 2006; Singhvi et al., 2005). This instrument, the size of a large briefcase, is readily portable, and provides real-time readings, allowing many samples to be obtained in a short period of time.

We conducted both indoor and outdoor field monitoring in the reference (C1) and study communities (S1) on twelve days from mid-November 2004 through February 2005. We visited each building once with the exception of a building in which we identified a previously unrecognized mercury spill. In that building, we coordinated subsequent visits with public health officials to verify the efficacy of remedial measures. For consistency, we report data collected on our first visit to that site.

We operated the instrument continuously in a mode that allowed display of both real-time and 10-second average Hg⁰ vapor concentration. We positioned the sample inlet at a height of about 1 m. We evaluated one-sample location on each level (floor) of a building when the common area was contiguous to all of the residential apartments on that floor. In segmented buildings divided into wings, we monitored in

Table 1 – Comparison of multifamily residential building characteristics and demographics among reference and study areas

	Reference Area (C1)	Study area 1 (S1)	Study area 2 (S2)
Multifamily building characteristics			
Year of construction (95th percentile)	1947	1955	1994
Percent with fluorescent lights in common areas	54%	71%	19%
Ventilation status: (CO ₂ in/CO ₂ out, 95% CI)	2.1 (1.9, 2.3)	2.3 (2.2, 2.4)	Not assessed
Demographic characteristics			
Median Family Income (1999\$)	96,252	33,165	56,943
Families below poverty level	3.90%	17.30%	13.60%
% Hispanic or Latino	5.10%	80.50%	11.40%
% West Indian of Haitian origin	1.20%	0.10%	13.80%
% Other West Indian origin	5.10%	0.50%	17.50%
% Asian Indian	1.40%	1.50%	11.40%

each wing. At each sample location, we recorded the time-integrated Hg^0 vapor concentration for each of three consecutive 10-second intervals. We utilize the mean of these three values as the Hg^0 vapor concentration.

In the reference (C1) and study area (S1), we recorded Hg^0 measurements at 370 locations in common hallways (C1=136, S1=234). We also measured mercury vapor outdoors in proximity to buildings on each sampling date and recorded data at 109 locations (C1, $n=46$; S1, $n=63$). We visited area S2 once in February 2005 and recorded Hg^0 measurements at 56 locations in common hallways and 7 outdoor locations using the same procedures. We include data from our prior investigation, [Garetano et al. \(2006\)](#), to estimate the prevalence of households in the study community (S1) that might have elevated mercury vapor levels.

2.3. Mercury vapor monitoring — quality assurance

Before and after each sampling session, we calibrated the spectrometer with an internal mercury cell and evaluated the relative deviation (RD) between measured and expected Hg^0 vapor concentration. On all tests, the measured and expected Hg^0 vapor concentration varied by less than 14% (mean \pm SD, $8.1\pm 2.4\%$). We found no significant difference in performance tests before and after each monitoring period (Wilcoxon Signed Rank test, $p=0.68$).

We evaluated the precision of triplicate measurements at 486 sample locations where Hg^0 concentration exceeded the spectrometer detection limit (2 ng/m^3). The average relative deviation was 12.6% (95% CI, 11.7%, 13.5%) with no difference in variability between measurements in areas C1 or S1 (MW *U*-test, $p=0.98$). The relative deviation of measurements in area S2 was 9% (95% CI, 7.4%, 10.6%). These data in conjunction with our continual observation of the consistency of real-time Hg vapor measurements provide us assurance that our measurements are accurate and precise.

2.4. Additional data utilized

We measured indoor and outdoor carbon dioxide (CO_2) concentration in areas C1 and S1 to assess building ventilation status. We used a direct reading instrument (Qtrak™ model 8851, TSI Inc., St. Paul, Minn.) that was within its recommended factory calibration schedule and also performed calibration checks each day. We logged CO_2 concentration simultaneous with Hg^0 monitoring in each building. We also recorded the outdoor CO_2 concentration in each area on each date. We calculate the ratio of indoor to outdoor CO_2 ($\text{CO}_2_{\text{in}}/\text{CO}_2_{\text{out}}$) for each building, and use this value to compare ventilation status between buildings in each area.

We examined additional factors that might influence mercury concentration in each building including; type of ventilation system, open windows or doors, and fluorescent lighting. Fluorescent bulbs contain mercury, and we suspected that occasional bulb breakage would result in mercury contamination ([Aucott et al., 2003](#)).

We use hourly outdoor temperature obtained from a National Weather Service monitoring station within 20 km of C1 and S1 to evaluate potential temperature differences between the reference and study community during the monitoring period.

2.5. Statistical Analysis

We used SPSS for Windows® version 11.0.1 for data analysis (SPSS Inc., Chicago, IL.). We evaluated data distributions graphically and determined goodness of fit with a normal distribution using the one-sample Kolmogorov–Smirnov test. We used the *t*-test for comparison of means for variables that fit a normal distribution and otherwise used the Mann–Whitney *U* nonparametric comparison test. We compared related variables with the nonparametric Wilcoxon Signed Rank test (WSR test). We use the Kruskal–Wallis nonparametric one-way analysis of variance test for comparisons involving more than two groups. We compared count data among groups with contingency table analysis and utilize the chi-square statistic (χ^2) and report the continuity corrected χ^2 (Yates correction) where appropriate.

Where reported, the mean Hg^0 vapor concentration for an entire building represents the arithmetic mean of the Hg^0 vapor concentration on each floor. For those buildings with multiple wings, the average of all sample locations on that floor represents the Hg^0 concentration for that floor. The maximum or peak indoor Hg^0 concentration is the maximum Hg^0 vapor concentration at any location within a building and represents the average of three sequential 10-second measurements at that location. We consider *p*-values of 0.05 or less as significant, but report higher *p*-values for information purposes.

3. Results

3.1. Population and building characteristics

Table 1 provides a summary of relevant population demographics, building vintage, ventilation status and the prevalence of fluorescent lighting in each community as fluorescent bulbs are a source of mercury.

The residents in the study community (S1), are predominantly Latino (>80%) as compared to approximately 5% in the reference community. Overall, the number of residents of ethnic origins (largely Latino) associated with cultural mercury use was significantly greater than in the reference community (C1) ($\chi^2=97.6$, $p<0.001$). This was also true when we compared S2, in which greater than 40% of the residents are of West Indian, or Asian Indian origin with C1 ($\chi^2=38.3$, $p<0.001$). While the majority of the population in both S1 and S2 were of ethnic origin associated with cultural mercury use, the West Indian and Haitian population in S2 was significantly greater than that in S1 ($\chi^2=34.8$, $p<0.001$).

Multifamily buildings in both the C1 and S1 are typically greater than fifty years old with no significant difference in building age between the communities (MW *U*-test, $p=0.56$). The multifamily housing stock in the S2 area is of more recent vintage than either C1 or S1. All buildings in each area use natural gas supplied by a public utility for cooking. We found heating systems that utilize hot water or steam radiators in all buildings. No ventilation systems that introduce outside air to common areas or circulate air between areas of a building were noted. Additionally, no open windows or exterior doors were observed during the monitoring period.



Fig. 1 – Foreground left: amalgam icon — Parad Shivling. This item weighed 10 g and emitted 0.3 $\mu\text{g/h}$ Hg^0 vapor at 24 °C. Foreground right: gelatin capsules containing Hg^0 . The clear capsule contains 9 g Hg^0 and was purchased in the study area for \$1.00. We purchased the colored capsules in the Dominican Republic at a similar cost. Rear left: bottle of elemental mercury. This bottle contains approximately 2 kg Hg^0 and was the source of spilled Hg in the reference community (C1). Rear center and right: Agua de Florida, and 7 Escencias. We purchased these items in the Dominican Republic also. The store clerk suggested we mix these items with mercury from the capsules and apply the mixture to floors in the home twice per week. These products typically contain water, alcohol, and essential oils. We do not believe they contain mercury though we did not analyze them.

We found the CO_2 concentration in building common areas (555 ± 140 ppm) to be approximately double that of outdoors (255 ± 44 ppm) with an average CO_2 in/ CO_2 out ratio of 2.2 (SD ± 0.6). This ratio did not significantly differ between C1 (2.1 ± 0.7) and S1 (2.3 ± 0.4) (t-test, $p=0.13$).

The mean outdoor temperature during the periods we monitored ranged from -2 °C to 10 °C (3.1 ± 3.7 °C). The difference in outdoor temperature between C1 and S1 on the dates we monitored them separately was not significant (MW U-test, $p=0.38$).

We noted fluorescent lighting in common areas in 53.8% and 71% of buildings in C1 and S1 respectively (χ^2 , 3.0, $p=0.08$). This percentage was lower in S2 (19%) than C1 or S1 (χ^2 , 17.4, $p<0.001$).

3.2. Mercury vapor concentration in buildings

3.2.1. Building with a Hg^0 spill

We detected high Hg^0 vapor levels in one building in C1. We found 4 to 1270 ng/m^3 Hg^0 in common areas and up to 5500 ng/m^3 in the caretaker's office. We localized the source to the basement floor just outside the elevator and verified subsequent tracking of Hg^0 onto the elevator floor and floors outside the elevator in building hallways. Hg^0 vapor levels in the common areas above the ground level (mean \pm SD, 162 ± 43 ng/m^3) were greater than those on the ground level where elevator use is unlikely (mean \pm SD, 14 ± 10 ng/m^3). The building superintendent indicated he had recently found a “heavy bottle” in the basement outside the elevator. He noted no visible spillage, nor did we. The bottle was partially full, containing about 2 kg of Hg^0 (Fig. 1). The source of the bottle is not known, but based on its location and the type of container; it is not likely to be related to cultural uses.

Our findings were immediately referred to public health officials enabling prompt remedial measures. In subsequent data analyses we note where data from this outlier building is excluded.

3.3. Comparison of indoor and outdoor mercury vapor concentration

Table 2 provides a summary of outdoor Hg^0 vapor levels in each area. Outdoor levels were slightly higher in the study community (S1) than the reference community (C1) (MW U-test, $p=0.2$). Outdoor Hg^0 vapor levels were greater in S2 than either S1 or C1, but the small sample size in area S2 limits meaningful comparison.

Table 3 summarizes the mean and maximum Hg^0 vapor concentration in building common areas. We compared both peak and mean indoor Hg^0 vapor levels with those outdoors on both an aggregate and area-specific basis and found them to be significantly greater than those outdoors (MW U-test, $p<0.001$). We also compare both mean and maximum indoor Hg^0 vapor concentration for each building in C1 and S1 with the area-specific 95th percentile outdoor concentration. In area S2 we utilize the mean outdoor Hg^0 vapor concentration plus two standard deviations as a basis of comparison since we had insufficient outdoor samples to estimate the 95th percentile. For purposes of further comparison we refer to these outdoor Hg^0 vapor levels as the “outdoor upper limit”.

The maximum interior Hg^0 concentration exceeded the area-specific outdoor upper limit in 43% of buildings (53 of 122) while the mean interior Hg^0 concentration exceeded the area-

Table 2 – Comparison of outdoor Hg^0 vapor concentration by area (ng/m^3)

Percentiles										
Area	No.	Mean \pm SD	GM	Max	10th	25th	50th	75th	90th	95th
C1	43	2.3 ± 1.6	1.9	7.0	1.0	1.0	2.0	4.0	5.0	5.8
S1	63	2.9 ± 2.4	2.2	12.0	1.0	1.0	2.0	3.0	6.0	9.6
S2	7	3.9 ± 3.7	2.7	12.3	2.0	2.0	3.0	3.0	–	–

Statistical comparisons:

All groups (Kruskal–Wallis test, $p=0.12$).

C1 versus S1 (Mann–Whitney U-test, $p=0.20$).

General range of values in United States is 2–10 ng/m^3 (ATSDR, 1999).

Table 3 – Mean and maximum mercury vapor concentration in building common areas (ng/m³)

Mean Hg ⁰ vapor concentration in building common areas												
Percentiles												
Area ^a	No.	Mean ± SD ^b	GM	5th	10th	25th	50th	75th	90th	95th	Compared to C1	
C1	38 ^c	5.0 ± 3.0	4.1	0.6	1.9	2.6	4.2	7.4	9.1	11.0		
S1	62	9.8 ± 11.3	6.3	1.5	2.0	3.3	5.3	14.5	18.6	32.0	p=0.02	
S2	21	15.4 ± 18.4	11.4	6.3	7.1	7.7	8.7	15.2	43.6	81.1	p<0.001	
Maximum Hg ⁰ vapor concentration in building common areas												
Percentiles												
Area	No.	Mean ± SD ^b	GM	5th	10th	25th	50th	75th	90th	95th	Max	Compared to C1
C1	38 ^c	6.4 ± 4.1	5.1	0.7	2.3	3.3	5.5	8.8	12.4	14.2	18.0	
S1	62	13.3 ± 14.9	8.8	2.7	3.1	4.7	7.0	17.8	33.5	42.6	79.3	p=0.01
S2	21	19.0 ± 23.5	13.1	7.0	7.4	7.9	9.7	16.7	63.7	96.7	99.7	p<0.001

^a(C1) reference community, (S1) study community, (S2) study community 2.
^bKruskall–Wallis ANOVA among all three areas, *p*<0.001.
^cBuilding in C1 with spill excluded; difference remains significant if included.

specific outdoor upper limit in 34% (*n*=42). We noted no significant difference between S1 and C1 with regard to the proportion of buildings in which maximum or mean Hg⁰ vapor concentration in building common areas exceeded the area-specific outdoor upper-limit concentration (χ^2 , 0.06, *p*=0.97 and χ^2 , 1.7, *p*=0.41 respectively).

As expected, low mercury concentrations (mean ± SD, 4.5 ± 2.3 ng/m³, 95th percentile 8.7 ng/m³) were found in those buildings (66%, *n*=80) with mean levels less than the outdoor upper limit.

3.4. Comparison of indoor mercury vapor levels among areas

Both the average maximum (13.3 ng/m³) and mean (9.8 ng/m³) Hg⁰ vapor concentration are significantly greater in buildings in study area (S1) than in the reference area (C1) (max=6.4 ng/m³; mean=5.0 ng/m³) whether the outlier with the verified Hg spill is excluded (Mann–Whitney *U*-test, *p*=0.01 for max and *p*=0.02 for mean) or included (Mann–Whitney *U*-test, *p*=0.02 for maximum and, *p*=0.05 for mean). Mean and maximum indoor Hg⁰ vapor levels in S2 are also significantly greater than those in C1 (MW *U*-test, *p*<0.001) when the outlier is included.

Fig. 2 depicts a plot of the maximum Hg⁰ values from all buildings and reveals an inflection point close to 25 ng/m³ Hg⁰. This value is also the 90th percentile of the maximum Hg⁰ concentration for all buildings excluding that with a known mercury spill. We therefore consider Hg⁰ vapor readings greater than 25 ng/m³ at any location a signal of mercury release above background.

In the reference community (C1) only the building in which we located a Hg⁰ spill exhibited a signal of mercury release. Excluding this building, significantly more buildings in S1 (9 of 62, 14.5%) had signals of Hg⁰ release than in C1 (χ^2 ; 6.1; *p*=0.01; continuity corrected χ^2 ; 4.4; *p*=0.04). When this building is included the difference between S1 and C1 is somewhat muted (χ^2 ; 3.8; *p*=0.05; continuity corrected χ^2 ; 4.4; *p*=0.11). In area S2, the number of buildings with signals (3 of 21, 14.3%) was essentially no different than in S1 (χ^2 ; 0.001; *p*=0.98).

3.5. Evaluation of variables that might influence mercury vapor concentration

A high indoor to outdoor CO₂ ratio (CO_{2 in}/CO_{2 out}) is indicative of lower “fresh air” ventilation. There was a positive but weak association between both maximum and mean indoor Hg⁰ concentration and the indoor to outdoor CO₂ ratio (Kendall’s tau-β, 0.15, *p*=0.07 and tau-β, 0.16, *p*=0.06). However, ventilation status did not differ significantly among buildings in areas C1 and S1.

We compared mean and maximum Hg⁰ concentrations in buildings with (*n*=69) and without (*n*=53) fluorescent lights. Contrary to expectation, buildings with fluorescent lights had significantly lower mean and maximum Hg⁰ vapor levels (9.0 ± 11.8 ng/m³ and 12.2 ± 16.0 ng/m³ respectively) than those without (11.7 ± 19.2 ng/m³ and 15.1 ± 26.7 ng/m³) (Mann–Whitney *U*-test, *p*=0.04 and *p*=0.08 respectively). Further, we observed no relationship between the presence of fluorescent lights and the presence of signals of Hg⁰ vapor release (χ^2 ; 0.95; *p*=0.33).

In those buildings with a Hg⁰ vapor signal, we further compared Hg⁰ vapor levels on the ground floor with those on upper floors under the presumption that if spills from gas meters or similar apparatus were present, Hg⁰ vapor levels would be highest closest to the source, typically the basement. We found slightly lower Hg⁰ vapor levels on the ground floor (52 ± 19 ng/m³) than on upper floors (65 ± 44 ng/m³). We found no significant difference in Hg⁰ vapor concentration by floor when we compared all floors simultaneously (Kruskall–Wallis test, *p*=0.99) or individually on post-hoc analysis (Dunnett *C*, *p*=0.85).

3.6. Estimated prevalence of households in study area (S1) that may generate Hg⁰ vapor signals greater than 25 ng/m³ in building common areas

During this evaluation and our prior survey in (S1) we monitored Hg⁰ vapor levels in the common areas of ninety-six non-duplicated residential buildings. The areas monitored adjoined 1325 of the 39,591 households in area S1. We detected twenty-seven discrete signals (>25 ng/m³ Hg⁰) of which we

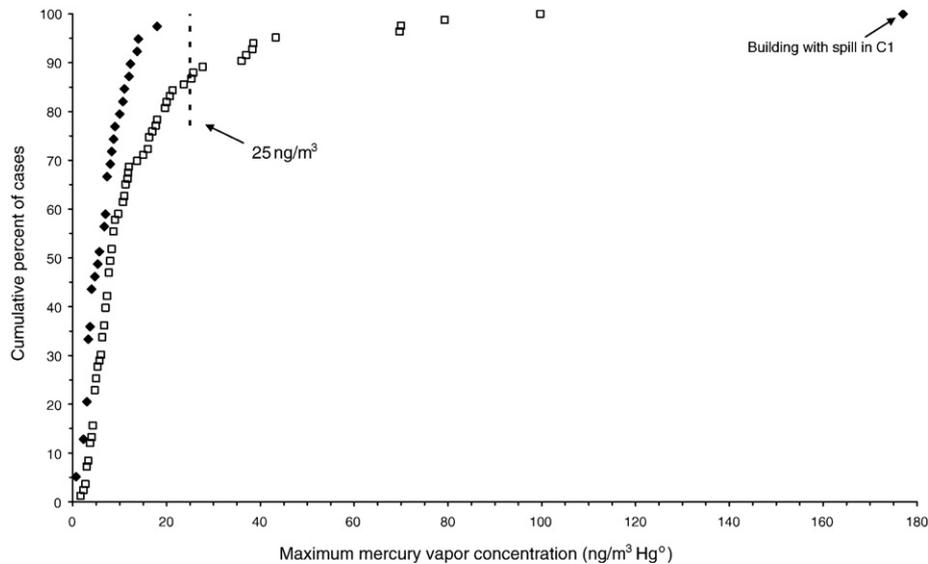


Fig. 2 – Cumulative probability plot of maximum Hg^0 concentration in building common areas ($n = 122$).
◆ Reference community (C1), □ study communities (S1, S2).

attribute twenty-three to residential apartments. In the remainder, the Hg^0 vapor source was localized to a spot on stairs or floors in the common area. We did not see visible mercury in any of these locations.

Thus, possibly 1.74% (95% CI: 1.05%, 2.40%) of households emitted enough Hg vapor to result in a signal within the common area. By extrapolation to all households in area S1, we estimate 689 (95% CI: 416, 962) or 17 per 1000 households (95% CI: 10–24 per 1000) may contain mercury vapor at a level sufficient to result in a signal $>25 \text{ ng/m}^3 \text{ Hg}^0$ in building common areas.

4. Discussion

The outdoor Hg^0 vapor levels we noted are consistent with expected values for suburban and urban areas reported elsewhere to range from about 2 to $10 \text{ ng/m}^3 \text{ Hg}^0$ (ATSDR, 1999; Garetano et al., 2006; Hladikova et al., 2001; Hopke et al., 2003; Peacheyran et al., 2000). Though we noted peak outdoor mercury vapor levels to be lower in study area (S1) in this investigation compared with our initial investigation (17 ng/m^3), our analysis provides assurance that the relationship of indoor and outdoor Hg^0 vapor levels are consistent with those previously reported for this community.

Our findings expand the sparse data concerning mercury vapor in residential buildings and support previous findings that mean indoor concentrations are significantly greater than outdoors (Carpi and Chen 2001; Foote 1972; Garetano et al., 2006). This was also true in the reference community where cultural mercury use is unlikely, possibly reflecting mercury emissions from sources such as broken thermometers or fluorescent bulbs. Though distinct from our primary inquiry, we believe the mercury levels we found in those 80 of 122 buildings with mean levels less than outdoor upper limits provide a preliminary reference range (mean \pm SD, $4.5 \pm 2.3 \text{ ng/m}^3$; 95th percentile, 8.7 ng/m^3) for Hg^0 vapor in common

areas of residential buildings relatively free of contamination from current or historic technologic or cultural Hg use.

Although we cannot estimate exposure from our data, we have demonstrated that both mean and maximum mercury vapor levels in the common areas of multifamily buildings as well as the prevalence of buildings with signals of mercury release ($>25 \text{ ng/m}^3 \text{ Hg}^0$) are significantly greater in communities where cultural mercury use is likely compared to a community where such mercury use is unlikely. Except for the building in the reference community in which we identified a previously unrecognized mercury spill, we detected $>25 \text{ ng/m}^3 \text{ Hg}^0$ only in the study area which is consistent with our hypotheses.

We cannot attribute the greater prevalence of elevated mercury vapor levels in either of the study communities to cultural use with absolute certainty, but we have no alternate explanation. We selected a reference community in which multifamily buildings had similar characteristics to those in the primary study community. We further controlled for other building and climatic factors that might influence mercury vapor concentration and believe they did not influence our findings. In the secondary study community (S2), buildings were of more recent vintage, probably with less building related uses of mercury, yet mercury levels were greater than the reference community.

Household contamination secondary to occupational exposure could contribute to Hg^0 vapor levels in residential buildings. We consulted the agencies responsible for environmental regulation associated with the reference and study communities (C1 and S1). Other than the potential use of sealed devices such as gauges and switches, neither we nor the regulatory agencies are aware of employers utilizing elemental mercury except dental offices. Dentistry remains a source of occupational mercury exposure in these as well as most communities though we found no reports of household contamination from this exposure. We did not control for occupational exposure but have no reason to believe such

exposure would differ between communities or influence our findings.

4.1. Comparison with reference concentrations used for public health evaluations

The Agency for Toxic Substances and Disease Registry has set a Minimum Risk Level (MRL) of 200 ng/m³, as the level below which continuous residential exposure is not associated with detectable adverse effects. “This level is the amount of mercury vapor in the air that is unlikely to produce adverse health effects based on a continuous exposure over a person’s lifetime. The MRL does not indicate a threshold level above which toxic effects are likely to occur”, but rather provides a trigger or screening level to suggest to public health officials that a closer examination of the potential exposure may be warranted,” (ATSDR, 1999). The mercury MRL is based on tremor in adult male workers and includes a 30-fold uncertainty factor.

In all locations other than the building with spilled Hg⁰, none of the mercury concentrations approached the ATSDR MRL. However, it is important to point out that these measurements reflect levels only in common areas and not in apartments where concentrations are likely to be higher and where exposure is likely to occur over a longer duration. We also note that investigations subsequent to publication of the MRL suggest some individuals with specific genetic polymorphisms exhibit increased susceptibility to adverse neuro-behavioral effects from low-level Hg⁰ exposure (Echeverria et al., 2006, 2005).

We believe the signals provided by spot measurements of mercury vapor concentration in building common areas are a relevant screening tool to identify the presence of mercury release within a building regardless of its source. Obtaining data on the relationship between mercury levels in common areas versus those in living areas could be a useful next step.

The generalization of our findings is limited by the cultural composition of the residents in areas we investigated as well as the number of locales investigated. Our findings are applicable only to larger multifamily residential buildings though there is no reason to believe cultural mercury use is restricted to occupants of that building type. Our evaluation is a snapshot of mercury vapor concentrations in the buildings surveyed and does not evaluate temporal variation of mercury concentration. Mercury emission from dispersed droplets may rapidly decrease as demonstrated by Singhvi et al. (2005), or it may increase as surface area of droplets is increased by disturbing them. Additionally, cultural practices may be conducted on auspicious days or even in particular seasons (Figuroa, personal communication). Since we conducted our evaluation in the reference community and study community in the same season, alternating visits to each without regard to day of the week, we find no reason to believe that short-term temporal variation in mercury concentration would bias our findings either positively or negatively.

We believe the “signals” of Hg⁰ release we observed in the communities where cultural use is likely provide empirical data that mercury is dispersed in more residential buildings in these communities than elsewhere. Our findings are consistent with previous reports (Wendroff, 2005; Riley et al., 2001;

U.S. EPA, 2002), and lead us to conclude that some individuals in these communities may be exposed to elevated Hg⁰ vapor from cultural practices. Considering the turnover in apartment habitation, current residents may be unknowingly exposed to residual mercury from prior spills or practices.

We believe our findings merit targeted public health intervention including culturally appropriate educational outreach, voluntary biomonitoring, and air monitoring for purposes of exposure assessment where indicated, in communities where cultural mercury use is likely. We agree with the position of Riley et al. (2006, 2001) and the U.S. EPA (2002) that a regulatory approach to this issue may drive this issue further underground lessening the likelihood of effective intervention. There are a variety of possible non-regulatory approaches based on outreach and education. Given the potential sensitivity of communities to this issue, approaches should be carefully selected with attention to the specifics of community structure and institutions both formal and informal.

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AN EVALUATION OF POTENTIAL EXPOSURE TO MERCURY IN A COMMUNITY [Union City & West New York, NJ] WHERE MERCURY IS USED FOR CULTURAL PURPOSES

Doctoral Dissertation, School of Public Health, University of Medicine and Dentistry of New Jersey

January, 2006

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**Dissertation Director
Michael Gochfeld, M.D., Ph.D.**

ii

ABSTRACT OF THE DISSERTATION

Elemental mercury is used in a variety of superstitious and cultural practices. These practices involve **intentional dispersal of mercury within residential buildings** by individuals who believe this will provide some benefit or ward off harm but may represent **an insidious source of mercury exposure**.

iii

We determined that cultural mercury use is a likely source of exposure for a small but noteworthy percentage of individuals in communities where there is such use.

6

Chapter 1

Comparison of Outdoor Mercury Vapor Levels to Levels in Common Areas of Residential Buildings in a Community where Mercury is used for Cultural Purposes

10

We hypothesize that elevated levels of mercury vapor are present in residential buildings in communities that engage in cultural use of mercury compared with outdoors. We further hypothesize that elevated levels can serve as a signal of significant cultural use in addition to unintentional breakage and spillage from other sources.

14

Windows and doors to residential apartments primarily influenced ventilation within the hallways. **12 of 34 (35%) buildings had open hallway windows during the time of the visit.**

16

Mercury concentration within the botanicas was significantly higher than that within the residential buildings ($P < 0.01$).

In the remaining five buildings, mercury vapor concentration increased as certain individual or groups of apartment entrances were approached. No visible contamination was noted in any of the cases and the actual source of vapor remained unknown.

18

Although our data are not intended as estimates of residential exposure to mercury vapor they do indicate that, compared with outdoor levels, such exposures are likely in a significant proportion of multifamily residential buildings in an area with known cultural uses of mercury.

19

Though the exact source was not identified, **the potential source of mercury vapor seemed to be residential apartments** in five of the buildings with elevated mercury vapor concentration. ... Our... findings are consistent with the hypothesis of cultural uses of mercury, but not definitive. **The elevated mercury vapor concentration found in botanicas is also consistent with its availability for cultural use.**

These measurements were not made in areas that directly reflect exposure, nor, for the most part, do they measure concentration at the emission source. Therefore, **these measurements could underestimate mercury concentration at the point of long-term exposure.** ... In most buildings surveyed, including those with the highest mercury vapor concentration, windows were open.

20

Whether exposure to elevated mercury vapor arises from intentional cultural uses or from unintentional breakage and spillage of mercury-containing equipment, **these exposures pose the potential for adverse health effects and should be addressed.**

Based on reports on the manner in which mercury may be used for cultural purposes, and our present findings, **we also recommend expanded screenings in areas where mercury may be used for cultural purposes** with the inclusion of suitable control locations.

26-27

Chapter 2

Comparison of Mercury Vapor in Residential Communities that use Mercury for Cultural Purposes with a Reference Community

After controlling for a number of factors that might influence Hg^0 vapor levels, **the most plausible explanation for greater Hg^0 vapor levels in the study area is cultural use of mercury.**

31

Extensive detail exists elsewhere on the prevalence, manner of use and availability of Hg^0 for cultural purposes (Johnson 1999; Johnson 2004; Ozuah et al. 2003; Riley et al. 2001; Stern et al. 2003; Wendroff 1990; Zayas and Ozuah 1996). Though mercury is available in communities where it is culturally, due to apprehension, a distrust of authorities and those outside the culture, it's sale or distribution to these "outsiders" is limited (Riley et al. 2001; Stern et al. 2003). This is not the case outside the U.S. where we readily purchased several grams of Hg^0 and other select liquids and received verbal instructions on the most auspicious days to spread them on the floor in the home with the recommendation to do so twice-weekly (see figure 1).

32

Although the magnitude of exposure to Hg^0 vapor from cultural use is unknown, **the hazard of Hg^0 vapor is well established and it is detectable years after small spills** from objects such as a fever thermometer (Carpi and Chen 2001; von Muhlendahl 1990). With larger spills, significant concentrations of Hg^0 vapor may persist for decades (Sasso et al. 1996). **This presents the specter of exposure to Hg^0 in residences from either unintentional or intentional Hg^0 releases without knowledge of such**

exposure. Wendroff (2005) contends cultural mercury use has created such a problem. Based on the described manner and frequency of mercury use by some individuals this contention is not without basis.

49

We cannot attribute the greater prevalence of elevated mercury vapor levels in this area or in the primary study community to cultural use with absolute certainty, but **we have no alternate explanation.**

49-50

Our method relies upon sensitive instrumentation to detect a signal of mercury release though the source may be distant. Thus, Hg⁰ vapor exposure near the source in apartments is likely to be significantly greater than we detected in common areas, unless as we noted on occasion, the source was in the common area.

50

When we examine these data in context with the prior literature, previous and ongoing biomonitoring programs, **there is no choice other than to acknowledge some percentage of individuals are needlessly and possibly unknowingly exposed to Hg⁰ vapor because of the cultural or folk use of mercury. This includes residents of apartments where mercury was used culturally by prior residents.**

59

Chapter 3

Evaluation of Urinary Mercury as a Biomarker of Exposure for Individuals Exposed to Mercury Vapor in a Non-occupational Setting

62-63

While noting sub-clinical neurological findings from low-level Hg⁰ vapor exposure, Heyer et al. (2004) put forth the supposition, *“It is possible that elemental mercury may follow the history of lead, eventually being considered a neurotoxin at extremely low levels.”*

83

We have demonstrated that the utilization of the value, 20µg/L, as the upper limit of normal urine mercury fails to identify significant exposure. All individuals in the lowest Hg⁰ vapor exposure category were exposed to Hg⁰ vapor at a level of magnitude above the U.S. EPA RfC (U.S. EPA 1995) and the ATSDR MRL (ATSDR 1999), yet two-thirds had urine Hg less than 20µg/L. If individuals in this group were the first to seek urine mercury screening, significant exposure might have been undetected. Thus, for this reason and those stated in the text, **we feel strongly that the value, 20µg/L, and the word “normal” should only appear together in a historical context.**

96

Chapter 4

Conclusions and Recommendations

97

The detection of elevated Hg⁰ vapor levels in residential buildings and botanicas supports the contention that mercury is available and released in residential buildings by cultural use.

However, the selection of reference buildings controlled factors likely to contribute to elevated Hg⁰ vapor levels leaving **cultural mercury use as the plausible explanation** for the difference in Hg⁰ vapor levels between the control and reference communities.

In summary we conclude:

1. **Hg⁰ vapor levels in the common areas of residential buildings in communities that use mercury for cultural purposes are significantly greater than those outdoors.**
2. **Hg⁰ vapor levels are significantly greater in the common areas of residential buildings in communities that use mercury for cultural purposes compared to those in communities where the use of Hg⁰ is unlikely.**
3. **Hg⁰ vapor exposure from cultural mercury use is likely in a small but noteworthy percentage of households in the study area.**
4. Biomonitoring of urine mercury is [a] reasonable tool to assess intermediate and chronic duration non-occupational exposure to Hg⁰ vapor, including that from cultural use, though at present, its sensitivity to detect exposure at less than 3µg/m³ Hg⁰ is unclear.

Recommendations for Public Health Action

The prevalence of cultural mercury use and the likelihood of exposure to Hg⁰ vapor at levels of public health concern warrant specific actions to address this use in communities where this practice exists. Though the extent of public health action might vary based on the prevalence of cultural use and associated Hg⁰ exposure, the following recommendations are relevant to the study communities surveyed in this research.

1. Culturally appropriate educational outreach activities, using written materials or other media that addresses sources of mercury, its health hazards, and resources for individuals who may be exposed are required. Educational materials must be accessible to individuals without deliberate action to seek information regarding mercury.
2. **Health care providers should be provided with educational materials and guidance regarding biomonitoring.**
3. **Public health clinics and appropriate community-based clinics should provide urine mercury screening to those individuals that reasonably believe they are exposed, regardless of their ability to pay for this analysis.**
4. **Local public health officials should have the capability, individually or regionally, to conduct mercury vapor monitoring with sensitive instruments. Monitoring in residences should be offered to all individuals with urine mercury above population norms. Public health officials should consider monitoring in all residences that request it.**

5. Recommendations 1 through 4 should be designed and implemented in a manner that allows

evaluation of their efficacy and relevance to other communities.

6. **A strategy should be developed by state and local public health and environmental officials, in consultation with federal officials, to guide response actions if residences with mercury vapor at levels of concern are identified.**

Recommendations for Additional Research

Research needs in addition to those that might accompany the recommended public health actions are also present.

1. **In other communities where there is cultural mercury use, air-monitoring surveys similar to that in Chapter 2 may be useful where deliberate public health action is deferred due to a lack of information regarding the prevalence of these practices.**
2. Studies to establish baseline levels of mercury vapor in residential buildings are warranted both to evaluate the contribution of indoor mercury vapor to total mercury exposure and to provide a basis of comparison for public health investigations involving indoor mercury vapor exposure.
3. The existing literature should be evaluated with consideration of the contribution of dental amalgam to urine mercury, to better describe the “normal” ranges of urine mercury in non-occupationally exposed populations.

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4. The effect of adjustment on urine mercury should be further evaluated in an attempt to aid interpretation of results and to foster consistency in reporting so that inter-study and inter-individual comparisons may be more relevant.

103

Appendix A

Determination of the Number of Households in the Study Area that Might Contain Elemental Mercury in Sufficient Quantity to Generate a Signal of Mercury in Common Areas of the Residence

105

By extrapolation, 1.74% of households (95% CI: 1.05%, 2.43%) or 689 (CI: 416, 962) of the 39,591 within the study area may contain mercury at a level sufficient to result in a Hg⁰ vapor signal of greater than 25 ng/m³ in building common areas. On average, there are 2.8 persons per household in this community.

Conclusion

The majority of households in the study area are not likely to contain Hg⁰ in sufficient quantity to generate Hg⁰ vapor signals of greater than 25 ng/m³ in common areas. Despite this, **the number of individuals in households where Hg⁰ is present at this level is of concern.**

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Curriculum Vita

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Re: Mercury Trackdown Sampling

Dear Doctor Wendroff:

This is in response to your May 11, 2003 letter to Commissioner Ward, concerning your renewed request for the Department of Environmental Protection (DEP) to monitor the wastewater levels of mercury in specific neighborhoods where residents may engage in religious/cultural uses of this toxic substance.

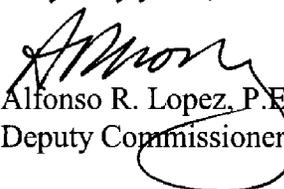
In a March 26, 2002 letter to you regarding this issue, I wrote that DEP was in the progress of performing a Headworks Analysis to quantify the sources of pollutants, including mercury, to the City's wastewater treatment plants. At the time, a recent New York Academy of Sciences study reported that dental facilities and hospitals were far greater contributors of mercury in wastewater than religious/cultural users. DEP used the recommendations of that study when formulating its data-collection strategy for the Headworks Analysis; religious/cultural use was not examined.

Since that time, DEP has completed its headworks study. The study found that virtually all of the mercury entering the city's water pollution control plants could be accounted for, except in the Wards Island drainage area. The source(s) of about 3 ounces per day of mercury entering the Wards Island plant was not identified. This plant serves the upper east side of Manhattan and the westernmost-third of the Bronx.

As a result of this finding, DEP will continue its investigation of potential mercury sources with this drainage area. Based upon your recommendation, DEP may agree to perform additional wastewater monitoring within a neighborhood location of your preference. Enclosed is a diagram delineating the areas that discharge to the Wards Island treatment plant.

Please telephone Mr. Vincent Sapienza, P.E., Director of Environmental Affairs at (718) 595-4906 with your suggestions. We appreciate your continued interest and input in this matter.

Very truly yours,


Alfonso R. Lopez, P.E.
Deputy Commissioner

enc: Wards Island Drainage Area Map

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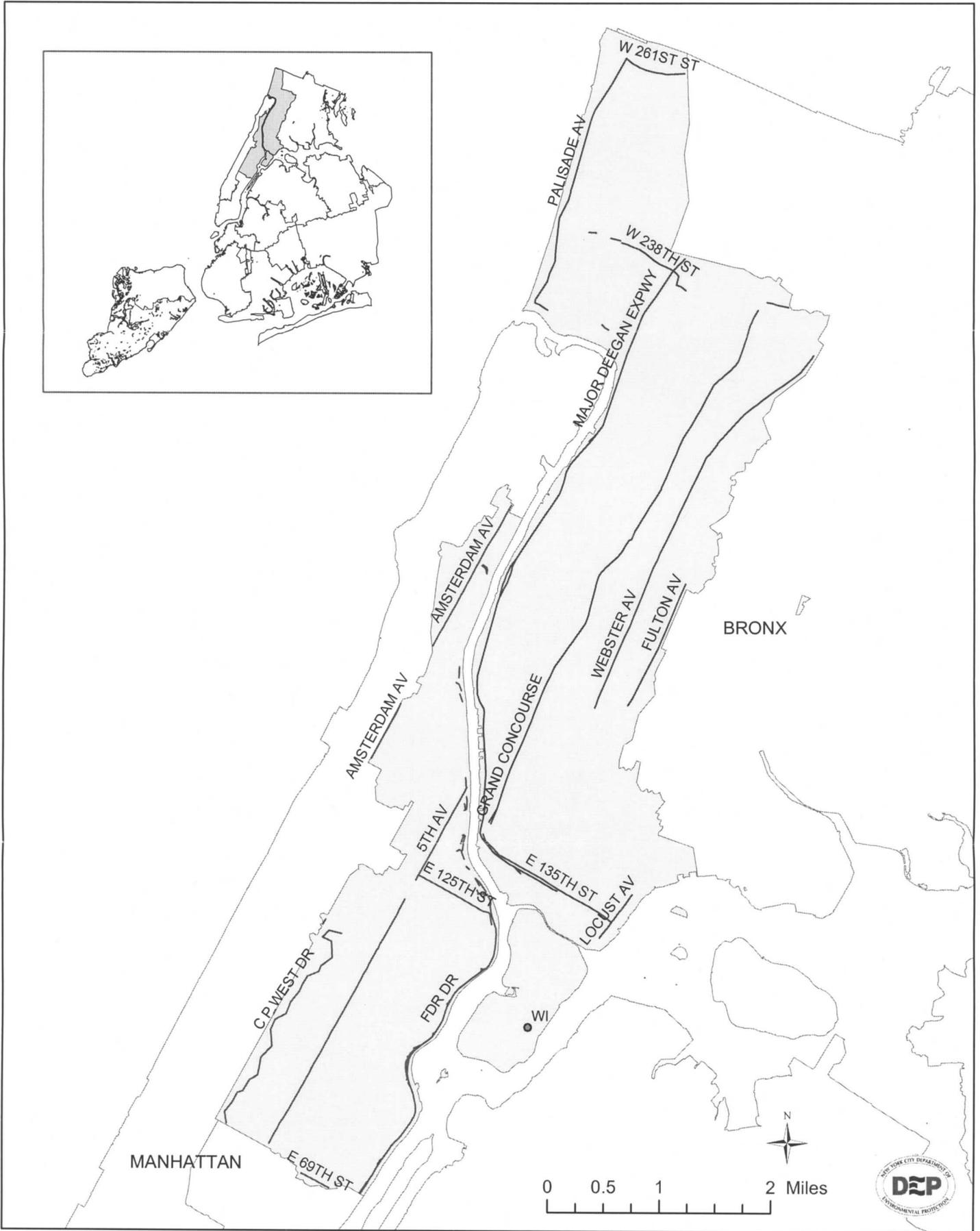
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Wards Island Drainage Area



Acrodynia and Hypertension in a Young Girl Secondary to Elemental Mercury Toxicity Acquired in the Home

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Abstract: Acrodynia, also known as pink disease, erythredema polyneuropathy, Feer syndrome, and raw-beef hands and feet, is thought to be a toxic reaction to elemental mercury and less commonly to organic and inorganic forms. Occurring commonly in the early 20th century, acrodynia is now a seemingly extinct disease in the modern world because of regulations to eliminate mercury from personal care products, household items, medications, and vaccinations. We present a case of a 3-year-old girl with acrodynia secondary to toxic exposure to elemental mercury in the home environment.

CASE PRESENTATION

A 3-year-old girl was admitted with a 3-day history of redness, pain and swelling of both hands, profuse sweats, irritability, chills, poor oral intake, and severe periumbilical pain. Within the 2 weeks before admission, she had been evaluated in the emergency department on two separate occasions for abdominal pain, which was diagnosed as constipation and viral gastroenteritis. Examination at admission revealed redness and edema of the hands and feet, desquamation of the fingertips and toes, and mild webspace maceration (Figs. 1 and 2). Lymphadenopathy, conjunctival injection, and mucous membrane involvement were absent. Blood pressure was 158/100. Differential diagnoses of her hypertension and systemic symptoms included pheochromocytoma, neuroblastoma, coarctation of the aorta, and vasculitis. Cutaneous differential diagnoses initially included atypical Kawasaki syndrome, postviral acral desquamation,

erythromelalgia, and juvenile plantar dermatosis in the setting of preexisting atopy. Total metanephrine level was high at 475 pg/mL (normal ≤ 205 pg/mL), but was nondiagnostic of a catecholamine-secreting tumor, which typically is greater than four times the reference range. Magnetic resonance imaging, angiography, and echocardiogram excluded internal masses, aortic coarctation, and other cardiovascular abnormalities. Thereafter, mercury toxicity was suspected, and later confirmed by a 24-hour urine mercury level of 178 $\mu\text{g}/24$ hours (normal 0–20 $\mu\text{g}/24$ hours). Hypertension was managed with amlodipine and labetalol. Chelation therapy with succimer was initiated. A compounded topical preparation containing mexiletine 2%, a lidocaine analog, and ketamine 2% applied to her hands and feet provided transient pain control. There was no history of excess fish intake or exposure to mercury, broken thermometers, batteries, or fluorescent bulbs. Environmental survey of the home, where the

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Figure 1. Desquamation of the fingers.



Figure 2. Desquamation of the toes.

family had lived for 2 months, revealed mercury levels in the carpet of $40,000 \mu\text{g}/\text{m}^3$ (normal $< 100 \mu\text{g}/\text{m}^3$). After 5 weeks of chelation therapy, all signs and symptoms had resolved.

DISCUSSION

Acrodynia, also known as pink disease, erythredema polyneuropathy, Feer syndrome, and raw-beef hands and feet, is a syndrome related to elemental mercury and, less commonly, inorganic mercury salt intoxication primarily in children (1,2). Chardon first described it in the French literature in 1830, and Crawford later recognized it in the American literature in 1932 (3,4), but it was not until 1948 that Warkany and Hubbard (5) established a

connection between acrodynia and mercury toxicity. It presents with the triad of edematous, painful, pink to red, desquamating fingers and toes; neurologic symptoms (irritability, photophobia, weakness, paresthesias); and hypertension (6). Elemental mercury exists as a liquid that can evaporate at room temperature. It is thought that elemental mercury toxicity affects children more often than adults because their nostrils are nearer the floor and because mercury vapor, which is heavier than air, settles near the floor because of the effect of gravity (6,7). In addition, children have higher minute volume respiration per unit of weight and therefore inhale more air per unit of body weight than do adults (7).

The diagnosis of acrodynia may be easily overlooked because of its current rarity in North America and Europe. As noted in the literature, there is substantial clinical overlap between acrodynia and Kawasaki disease (7). One author previously suggested mercury as the causative agent of Kawasaki disease (8). This led to a study evaluating mercury levels in six patients with a clinical diagnosis of Kawasaki disease; all were found to have high urinary mercury excretion, although later reports failed to confirm this association (9). Acrodynia should also be considered in the differential diagnosis for patients with presumed Kawasaki disease who are afebrile or have atypical presentations.

Another cardinal feature of acrodynia is hypertension. Mercury causes high blood pressure by inhibiting catecholamine-*O*-methyltransferase, the critical enzyme involved in catabolism of catecholamines, through direct inactivation of its coenzyme *S*-adenosylmethionine. Inhibition of catecholamine-*O*-methyltransferase by mercury results in accumulation of dopamine, epinephrine, and norepinephrine (10), which probably explains the high catecholamine levels seen in our patient. In addition to following mercury levels in response to treatment, catecholamine levels may also be tracked as a surrogate marker of therapeutic response (2).

Although it was determined that the patient in our case was exposed to elemental mercury in the carpeting of her new home, its source could only be speculated. Common residential sources include spillage from mercury-containing devices such as thermometers and contact with latex paint containing mercury added to prolong shelf life. In addition, some religions in Afro-Caribbean cultures, including Santeria, voodoo, and Palo, ritually sprinkle elemental mercury about the home to ensure health, wealth, and happiness (11,12). The concern with elemental mercury in flooring and upholstery is that it can persist for weeks to months, resulting in chronic exposure to mercury vapor (13). This may increase the risk of toxicity, because it has been shown that urine mercury levels correlate positively with duration of

residency in a contaminated building and total amount of time spent in the building (14). Vacuuming worsens mercury exposure by further dispersing the vapor, and clearance should not be attempted without guidance from the local health department (13).

One must have a high index of suspicion to recognize mercury toxicity. If suspected, laboratory testing of blood, urine, or hair samples can be performed for confirmation. Whole blood should be examined as opposed to serum, because mercury concentrates in erythrocytes, urine should be collected over a 24-hour period rather than spot checking, and the longest of hair strands should be evaluated (7). Because mercury has a short half-life in the blood but a long half-life in other tissues, blood samples are more useful for diagnosing acute poisoning, whereas urine and hair samples are better for diagnosis of chronic intoxication (7). Although reference levels are not well established for children, the threshold for toxicity is probably lower than in adults, and clinical correlation is recommended.

Treatment entails removal of the source of mercury exposure in the patient's environment with the aid of trained personnel and elimination from the body largely through chelation therapy. The Food and Drug Administration has not approved any therapy for mercury toxicity in children, but DMSA succimer is approved for the treatment of lead poisoning in children and has been adopted as the most commonly used chelating agent for mercury in the pediatric population (15). Other agents less commonly used are D-penicillamine, 2,3-dimercaptopropanol (British anti-lewisite, dimercaprol), and 2,3-dimercapto-1-propane sulfonic acid. Transient elevation in plasma mercury levels may occur with use of these agents because of oxidation within red blood cells (7). Repeat blood or urine mercury levels should be performed after chelation therapy to ensure that the level has decreased appropriately.

Although acrodynia is now relatively rare, cases such as ours may still be encountered. Awareness and recognition of the characteristic cutaneous findings of red, desquamating, and edematous hands and feet coupled

with high blood pressure and neurologic symptoms will prevent the diagnosis from being overlooked. Prompt diagnosis and treatment of this disorder may help prevent long-term neurological sequelae.

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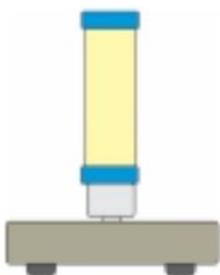
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DEFICITS IN PSYCHOLOGIC AND CLASSROOM PERFORMANCE OF CHILDREN WITH ELEVATED DENTINE LEAD LEVELS

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Abstract To measure the neuropsychologic effects of unidentified childhood exposure to lead, the performance of 58 children with high and 100 with low dentine lead levels was compared. Children with high lead levels scored significantly less well on the Wechsler Intelligence Scale for Children (Revised) than those with low lead levels. This difference was also apparent on verbal subtests, on three other measures of auditory or speech processing and on a measure of attention. Analysis of variance showed that none of these differences could be explained by any of the 39

THE neurotoxic properties of lead at high dose are well known and not a subject of general controversy.^{1,2} A source of considerable debate, however, is whether or not blood lead levels below those associated with obvious symptoms have adverse effects on the brain.^{3,4} Because the symptoms of milder lead intoxication are not dramatic, and may therefore evade precise identification, many efforts have been made to determine whether these lesser levels of lead are associated with undetected neuropsychologic impairment.⁵⁻¹¹

Among the reasons for discrepant conclusions in these earlier studies are the following methodologic difficulties shared to some extent by many of the reports:

Inadequate markers of exposure to lead. Most studies have relied on blood lead levels to classify subjects. Because blood lead is a marker of recent exposure, it may return to normal levels even though exposure was excessive. Errors are likely to occur, therefore, if blood lead is relied on to classify subjects after exposure has ceased.

Biased ascertainment of subjects. A study that attempts to provide conclusions applicable to the community at large must draw its sample from a representative population. Studies that select their subjects from health

other variables studied.

Also evaluated by a teachers' questionnaire was the classroom behavior of all children (2146 in number) whose teeth were analyzed. The frequency of non-adaptive classroom behavior increased in a dose-related fashion to dentine lead level. Lead exposure, at doses below those producing symptoms severe enough to be diagnosed clinically, appears to be associated with neuropsychologic deficits that may interfere with classroom performance. (N Engl J Med 300:689-695, 1979)

clinics, schools for the retarded or psychiatric clinics may not be representative of the population in general. Similarly, families who fear that their child has a deficit may respond to a study invitation in a systematically biased fashion, and either seek or avoid participation, depending on how the study is perceived.

Inadequate identification and handling of other confounding variables that affect development. A confounding variable is one that is differentially distributed in exposed and non-exposed groups and also affects the outcome under examination. Among the many potential confounders of effect of lead are genetic, perinatal, nutritional and socioeconomic variables. Because lead exposure is often associated with economic disadvantage, the multiple handicaps of poverty may frequently confound the effects of lead on development.

Insensitive measures of performance. Some studies have used group tests or mass screening examinations that cannot be expected to identify subtle degrees of neuropsychologic impairment. Sensitive measures are required to detect less than obvious deficit.

In this study we attempt to deal with these design issues while measuring neuropsychologic performance in relation to lead exposure in a group of children in the first and second grades, all of whom were considered asymptomatic for lead intoxication. Children were studied in two ways: those ranked in the highest and lowest 10th percentile for dentine lead concentrations were evaluated in the neuropsychologic laboratory. Their classroom behavior was also measured by teachers' ratings. In addition, all children whose teeth were analyzed had their classroom behavior evaluated by the same rating scale.

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The results of this study were reported in part at the Society for Pediatric Research, New York, NY, April 27, 1978.

Supported by a program project grant (HD-08945) from the National Institute of Child Health and Human Development.

METHODS

Sample

The 3329 children attending first and second grades in the period between 1975 and 1978 in Chelsea and Somerville, Massachusetts, made up the population sampled. Children were asked to submit their shed teeth to the teacher, who then verified and recorded the presence of an appropriate fresh socket.

Tooth Analysis

Teeth were cleansed ultrasonically, and any with fillings were discarded from consideration. The specimens were then mounted in a lead-free wax on the cutting stage of a Buehler low-speed saw. A 1-mm slice was taken from the central sagittal plane of each tooth at a single pass. The central slice was then placed on an anvil and split with a small chisel along a line from the pulp canal to the dentine-enamel junction. The larger portions of the slices, along with the residual adjacent segments, were filed in numbered pill boxes for later confirmatory analysis. The smaller portion, composed primarily of dentine, was then analyzed for lead by anodic stripping voltammetry.¹²

Classification of Subjects' Lead Exposure

Subjects whose initial tooth slice was in the highest 10th percentile (> 24 ppm) or lowest 10th percentile (< 6 ppm) were provisionally classified as having high or low lead levels respectively (Fig. 1). Whenever possible, a second dentine lead level, either from the opposite half of the initial slice or from the remaining tooth substance, was obtained. In addition, we attempted to obtain and analyze other shed teeth from each subject provisionally classified in either group. On all but one subject, more than one analysis was obtained. Agreement between replicate samples was required before the subject was included in the study. If three values were obtained, complete concordance was required. If four values were obtained, one discordant value was allowed but discarded from analysis. If agreement was not found, the subject was designated "unclassified" and excluded from data analysis. To be classified as high lead required a mean of all concordant samples greater than 20 ppm. To be classified as low lead required a mean of less than 10 ppm.

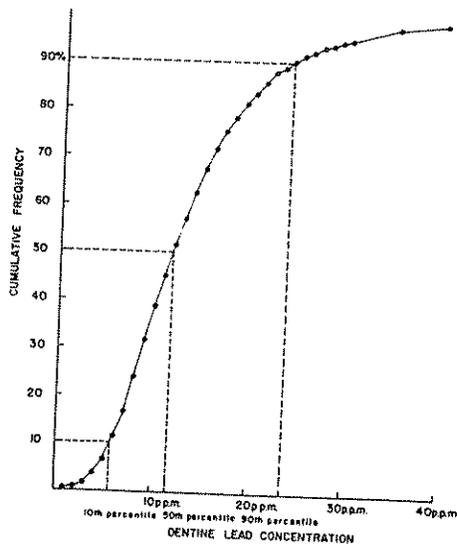


Figure 1. Cumulative Frequency Distribution of Dentine Lead Concentrations (3221 Specimens). The points plotted are actual (unsmoothed) values.

Table 1. Reasons for Excluding Subjects and Distribution of Final Dentine Lead Levels in Included and Excluded Groups

GROUP	No.	DENTINE LEAD LEVEL		
		LOW	HIGH	UNCLASSIFIED
Provisionally eligible subjects:	524	258	187	79
Excluded from neuropsychologic testing:	254*	123	101	30
Bilingual home	84			
Not interested	57			
Moved	19			
Other†	94			
Total	254			
Subjects tested:	270‡	135	86	49
Excluded from data analysis:	112	35	28	49
Later tooth discordant	36			
Not discharged from nursery with mother, possible head injury, reported to have plumbism or bilingual home	76			
Total	112			
Cases scored & data analyzed	158	100	58	—

*Teachers' behavioral assessment available on 235.

†Infant at home, two working parents, etc.

‡Teachers' behavioral assessment available on 253.

Criteria for Exclusion

Parents of children with confirmed high and low levels were invited to participate in the further neuropsychologic evaluation of their child. Excluded, usually by telephone interview, were children from homes in which English was not the first language, whose parents either did not wish to participate, or were not able to participate for other reasons — e.g., an infant child at home or two working parents. Also excluded, after a medical history was obtained, were children whose birth weight was below 2500 g, who were not discharged at the same time as their mother after birth or who had a history of noteworthy head injury. Any child who had been diagnosed as lead poisoned was excluded. Some subjects, initially confirmed as having high or low lead levels, were later excluded from analysis because teeth subsequently submitted had values discordant from initial determinations (Table 1).

The Neuropsychologic Evaluation

The parent (usually the mother) and child were brought by taxi to the testing location. While the parent filled out a comprehensive medical and social history, received a 58-item questionnaire evaluating parent attitude in six areas and received a Peabody Picture Vocabulary I.Q. Test,¹³ the child received a comprehensive neuropsychologic battery, administered in fixed order, beginning with the Wechsler Intelligence Scale for Children — Revised. The examiners were blind to the child's lead burden during the conduct of the examination and remained so until all tests were coded. After examination was completed and all tests scored, the principal investigator informed the parents of the child's lead status and counseled them about the proper course of action.

The following tests were administered as the neuropsychologic battery to the subjects who qualified and whose parents elected to participate in the detailed evaluation:

Psychometric intelligence. Wechsler Intelligence Scale for Children — Revised¹⁴: six verbal and six performance subtests.

Concrete operational intelligence. Piagetian conservation of number, substance and continuous quantity.¹⁵

Academic achievement. Peabody tests¹⁶ of mathematics, reading recognition and reading comprehension.

Auditory and language processing. Sentence Repetition Test,¹⁷ Token Test,¹⁸ Seashore Rhythm Test¹⁹ and Wepman Auditory Discrimination.²⁰

Visual motor competence. Visual Motor Integration Test²¹ and Frostig Test.²²

Attentional performance. Reaction time under intervals of varying delay²³ and cognitive control battery.²⁴

Motor co-ordination. Elements of the Halstead-Reitan Battery.²⁵

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* REPORTED BY TEACHERS

Table 2. Comparison of Tested and Excluded Subjects on Teachers' Behavioral Rating Scale — the Numbers Show the Per Cent of Students in Each Group Receiving a Negative Response.

ITEM	TESTED GROUP (%)	EXCLUDED GROUP (%)
Distractible	26	34
Not persistent	15	19
Dependent	17	20
Disorganized	18	18
Hyperactive	9	7
Impulsive	13	14
Easily frustrated	18	23
Daydreamer	25	23
Not able to follow:		
Simple directions	7	12
Sequence of directions	19	24
Low overall functioning	17	25

lead level was then compared for the entire sample of 2146 subjects (Fig. 2). Finally, item and sum scores were compared for the 58 children with high and the 100 with low lead levels who received the neuropsychologic evaluation (Table 3).

Control Variables

Thirty-nine non-lead variables that could affect the subject's development were scaled and coded. A partial list is shown in Tables 4 to 6. The variables not included did not differ between groups. Data were obtained by a paper-and-pencil questionnaire. Parental socioeconomic status was estimated by a two-factor Hollingshead index.²⁶

Data Analysis

The scores of children with high and low lead levels on 39 control variables were compared with use of the Student t-test. We then compared outcome measures in the 58 children with high and the 100 with low levels, using analysis of covariance (Statistical Package for the Social Sciences) with dentine lead level as the main effect, and the following covariates: mother's age at subject's birth; mother's educational level; father's socioeconomic status; number of pregnancies; and parental I.Q. We normalized outcomes for which age-normed scores were not available by regressing for age before analysis of covariance.

Frequency of negative reports on teachers' behavioral ratings was evaluated by chi-square test, both for the 158 subjects with high and low lead levels and for the entire sample of 2146 subjects as well. Non-lead covariates were not controlled in these analyses. Sum scores of teachers' ratings for subjects with high and low lead levels were compared by analysis of covariance with the covariates listed above.

RESULTS

Dentine Lead Levels in Somerville and Chelsea

Of the total population of 3329 eligible children, 2335 (70 per cent) submitted at least one tooth for analysis (Fig. 1). Although the distribution of dentine lead levels in the first slice was closely balanced between high and low concentrations, more subjects with initially high values required reassignment as "unclassified" on the basis of later analyses. As a result, the final sample was composed of a larger number of subjects with confirmed low lead levels (Table 1).

Twenty-three subjects with "high dentine lead" and 58 with "low dentine lead" were discovered to have had blood lead determinations in an earlier screening project (1973-1974, four to five years before

Teacher's Behavioral Rating

The teacher of every child who gave a tooth was asked to fill out an 11-item forced-choice behavioral rating scale scoring the child as "yes" or "no" on the following questions:

1. Is this child easily distracted during his/her work?
2. Can he/she persist with a task for a reasonable amount of time?
3. Can this child work independently and complete assigned tasks with minimal assistance?
4. Is his/her approach to tasks disorganized (constantly misplacing pencils, books, etc.)?
5. Do you consider this child hyperactive?
6. Is he/she over-excitable and impulsive?
7. Is he/she easily frustrated by difficulties?
8. Is he/she a daydreamer?
9. Can he/she follow simple directions?
10. Can he/she follow a sequence of directions?
11. In general, is this child functioning as well in the classroom as other children his/her own age?

This form was completed by the teachers (who were blind to the lead level) after at least two months of classroom experience with the child. Sum scores (11 = good, 0 = poor) and item analyses were computed. The scale was obtained for the 2146 subjects who submitted at least one tooth. These 2146 subjects were then divided into six groups according to dentine lead level: Group 1, < 5.1 ppm; Group 2, 5.1 to 8.1 ppm; Group 3, 8.2 to 11.8 ppm; Group 4, 11.9 to 17.1 ppm; Group 5, 17.2 to 27.0 ppm; and Group 6 > 27.0 ppm. The boundaries were chosen to achieve a symmetrical distribution in each cell around the median.

Data from this rating scale were evaluated in three ways. Scores of participating and excluded subjects were first compared to evaluate any bias in sampling that might have occurred (Table 2). The incidence of negative reports on each item in relation to dentine

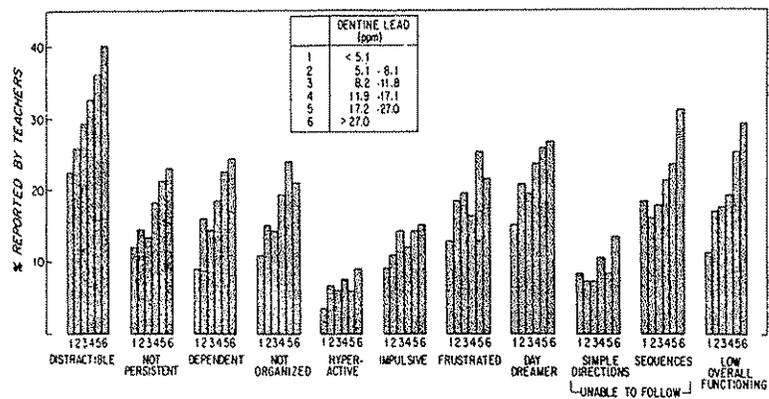


Figure 2. Distribution of Negative Ratings by Teachers on 11 Classroom Behaviors in Relation to Dentine Lead Concentration. The group boundaries were chosen to obtain symmetrical cell sizes for the median (Groups 1 and 6 = 6.8 per cent, Groups 2 and 5 = 17.6 per cent, and Groups 3 and 4 = 25.6 per cent).

Table 3. Comparison of High and Low Lead Subjects on Teachers' Behavioral Rating Scale. The Numbers Show the Per Cent of Students in Each Group Receiving a Negative Response.

ITEM	LOW LEAD (%)	HIGH LEAD (%)	P VALUE
Distractible	14	36	0.003
Not persistent	9	21	0.05
Dependent	10	23	0.05
Disorganized	10	20	0.14
Hyperactive	6	16	0.08
Impulsive	9	25	0.01
Easily frustrated	11	25	0.04
Daydreamer	15	34	0.01
Does not follow:			
Simple directions	4	14	0.05
Sequence of directions	12	34	0.003
Low overall functioning	8	26	0.003
Sum score (mean)	9.5	8.2	0.02*

*Analysis of covariance.

shedding teeth). Their records were obtained and previous blood levels in the two groups compared. The mean blood lead level in 1973-1974 was 35.5 ± 10.1 μg per deciliter for the group with high dentine lead and 23.8 ± 6.0 μg per deciliter for the group with low dentine lead ($P < 0.001$, by two-tailed t-test). The highest blood lead level in the children with high dentine lead levels was 54.0 μg per deciliter.

Evaluation of Sampling Bias

The teachers' behavioral assessment was available for 253 of the 270 children who did participate in the neuropsychologic evaluation and for 235 of the 254 who did not participate. Comparison of dentine lead levels (Table 1) and teachers' scores (Table 2) in tested and excluded subjects demonstrated that the two groups did not differ in either lead exposure or classroom behavior.

Table 4. Comparison of Non-Lead Variables in High and Low Lead Groups.

VARIABLE	LOW DENTINE LEAD	HIGH DENTINE LEAD	P VALUE*
General			
%Male	49.5	55.9	NS†
%White	97.0	98.3	NS
%Father head of household	77.2	67.8	NS
%Completed immunizations	98.0	98.3	NS
%Positive pica history	10.9	28.8	0.008
Physical variables at date of testing			
Age (mo)	87.2 ± 7.7 †	90.7 ± 8.4	0.009
Height (cm)	126.6 ± 6.3	126.4 ± 6.3	NS
Weight (kg)	25.8 ± 4.9	26.5 ± 4.6	NS
Head circumference (cm)	51.8 ± 1.6	51.7 ± 1.5	NS
Skinfold:			
Right arm (mm)	9.5 ± 3.5	9.8 ± 4.2	NS
Left arm (mm)	9.5 ± 3.4	9.7 ± 4.2	NS
Past medical history			
Birth weight (g)	$3,400.0 \pm 448.6$	$3,346.0 \pm 514.0$	NS
Length of infant hospital stay (days)	4.9 ± 1.8	4.4 ± 1.5	NS
Birth order	2.4 ± 1.7	2.7 ± 2.0	NS
No. of hospital admissions	0.47 ± 1.2	0.42 ± 1.6	NS

*2 tail.

†Mean \pm S.D.

‡Not significant.

Control Variables

Children with high and low lead levels were quite similar in most non-lead variables measured (Tables 4-6). The following variables, which differed at $P < 0.1$, were controlled as covariates in analysis of covariance: fathers' socioeconomic status (consisting of education and occupation score); mothers' age at subjects' birth; number of pregnancies; mothers' education and parental I.Q.

Outcome Measures

Children with high lead levels performed significantly less well on the Weschler Intelligence Scale (Table 7), particularly the verbal items, on three measures of auditory and verbal processing (Table 8), on attentional performance as measured by reaction time under conditions of varying delay (Table 8 and Fig. 3) and on most items of the teachers' behavioral rating (Table 3).

Table 5. Comparison of Parental Non-Lead Variables in High and Low Lead Groups.

VARIABLE	LOW DENTINE LEAD	HIGH DENTINE LEAD	P VALUE*
No. of pregnancies	3.3 ± 1.8 †	3.8 ± 2.3	0.10
Mother's age at subject's birth (yr)	26.2 ± 5.5	24.5 ± 5.8	0.07
Mother's social class (2-factor Hollingshead)	4.1 ± 0.8	4.2 ± 0.8	NS
Mother's education (grade)	11.9 ± 2.0	11.4 ± 1.7	0.08
Mother's occupation	5.5 ± 1.1	5.5 ± 1.3	NS
Father's age at subject's birth (yr)	28.8 ± 7.1	27.5 ± 7.9	NS
Father's social class (2-factor Hollingshead)	3.8 ± 1.0	4.1 ± 0.8	0.02
Father's education (grade)	12.7 ± 2.8	11.1 ± 2.3	0.001
Father's occupation	4.7 ± 1.6	5.0 ± 1.2	NS
Parent IQ	111.8 ± 14.0	108.7 ± 14.5	NS

*2 tail.

†Mean \pm S.D.

‡Not significant.

As compared to controls, children with high lead levels appeared particularly less competent in areas of verbal performance and auditory processing. They had lower scores on all tests of the Seashore Rhythm Test, which requires the subject to discriminate whether pairs of tone sequences of increasing complexity are alike or different. In the Token Test the task is to respond to verbal instructions of increasing complexity and to manipulate tokens of different shapes and colors. The four subtests are presented in order of increasing complexity and difficulty. The Sentence Repetition Test, which requires the immediate repetition of previously uttered sentences of increasing length and syntactic complexity, was also sensitive to the effect of lead exposure.

The ability of subjects with high lead levels to sustain attention was clearly impaired, as measured by reaction time at varying intervals of delay. Their reaction time was significantly slower on Blocks 2 and 3 (at 12 seconds' delay) as well as on Block 4 (at three seconds' delay). This final block was administered after about 15 minutes of repetitive testing, when subjects began to become distracted.

Table 6. Parental Attitude Scores in High and Low Lead Subjects.*

CONTROL VARIABLE	LOW DENTINE LEAD	HIGH DENTINE LEAD
Parental aspirations for child	19.7±5.6†	19.5±4.6
Home learning environment	37.6±6.3	37.1±5.4
Parental attitude toward school:		
Resignation	17.4±3.4	17.1±2.9
Futility	17.8±2.7	17.7±2.5
Conservatism	20.3±2.2	20.4±1.9
Parental attitude toward child	34.4±4.3	34.5±4.8
Parental restrictiveness	19.1±2.1	19.4±2.2

*No significant differences found.

†Mean ± SD.

Teachers' reports of classroom behavior showed that children with high lead levels were rated significantly poorer on nine of 11 items, and that the sum score of these subjects was lower.

Teachers' Behavioral Rating on Entire Study Sample

Teachers' behavioral ratings were available for 2146 (92 per cent) of the 2335 children who submitted teeth. The frequency of negative teachers' ratings for every item increased with increasing dentine lead level, and was not limited to the group with highest lead levels (Fig. 2).

DISCUSSION

The confidence with which the performance deficits reported here can be attributed to past lead exposure depends on whether this investigation has successfully addressed the four methodologic issues raised earlier (lead markers, sampling bias, confounding variables and sensitive outcome measures).

The classification of earlier lead exposure according

Table 7. Full-Scale and Subtest Scores of the Wechsler Intelligence Scale for Children (Revised) (WISC-R) for High and Low Lead Subjects.

WISC-R	LOW LEAD (MEAN)	HIGH LEAD (MEAN)	P VALUE*
Full-scale IQ	106.6	102.1	0.03
Verbal IQ	103.9	99.3	0.03
Information	10.5	9.4	0.04
Vocabulary	11.0	10.0	0.05
Digit span	10.6	9.3	0.02
Arithmetic	10.4	10.1	0.49
Comprehension	11.0	10.2	0.08
Similarities	10.8	10.3	0.36
Performance IQ	108.7	104.9	0.08
Picture completion	12.2	11.3	0.03
Picture arrangement	11.3	10.8	0.38
Block design	11.0	10.3	0.15
Object assembly	10.9	10.6	0.54
Coding	11.0	10.9	0.90
Mazes	10.6	10.1	0.37

*These 2-tail P values are those for any single comparison between high & low lead groups. It should be remembered that when a large no. of simultaneous comparisons are made between 2 groups of subjects, the probability that a "significant" result may be found is larger than the P value for the single test. An approximate & conservative adjustment for this fact may be obtained if the reported P value is multiplied by the no. of simultaneous tests. In this sense the "full-scale IQ" above constitutes a single test, & the "verbal IQ" and "performance IQ" constitute a pair of simultaneous tests. Within the verbal WISC there are 6 simultaneous tests, and within the performance WISC there are another 6 simultaneous tests. Thus, with the conservative adjustment described above the following P values would be obtained: full-scale IQ, P = 0.03; verbal IQ, P = 0.06; & digit-span, P = 0.12.

to dentine lead levels has been validated in a number of earlier studies. Lead exists in dentine in a closed storage system. Tooth lead levels in baboons do not change after a pulsed dose of ²⁰³Pb.²⁷ They are elevated in children with unequivocal plumbism,²⁸ urban children living in the "lead belt"²⁹ and those who live in decaying homes, or intact homes near a major lead processor.¹² Tooth lead levels also vary in relation to the concentration of lead in the domestic water supply and the duration of exposure to that water.³⁰

In our present study, the small number of blood lead levels in subjects drawn four to five years before tooth shedding documents the point that children with higher tooth lead levels tended to have had higher blood lead levels years previously.

Table 8. Verbal Processing Scores and Reaction Times in High and Low Lead Subjects.

TEST	LOW LEAD VALUES (MEAN)	HIGH LEAD VALUES (MEAN)	P VALUE*
Seashore Rhythm Test			
Subtest A	8.2	7.1	0.002
Subtest B	7.5	6.8	0.03
Subtest C	6.0	5.4	0.07
Sum	21.6	19.4	0.002
Token Test			
Block 1	2.9	2.8	0.37
Block 2	3.7	3.7	0.90
Block 3	4.1	4.0	0.42
Block 4	14.1	13.1	0.05
Sum	24.8	23.6	0.09
Sentence-Repetition Test	12.6	11.3	0.04
Reaction time under varying intervals of delay			
Block 1 (3 sec)	0.35±0.08†	0.37±0.09	0.32
Block 2 (12 sec)	0.41±0.09	0.47±0.12	0.001
Block 3 (12 sec)	0.41±0.09	0.48±0.11	0.001
Block 4 (3 sec)	0.38±0.10	0.41±0.12	0.01

*2 tail. See footnote to Table 6. The conservative adjustment for multiple simultaneous comparisons would yield the following P values: Subtest A of the Seashore Rhythm Test, P = 0.006; Block 4 of the Token Test, P = 0.20; & Blocks 2 & 3 of the Reaction Time Test, P = 0.004.

†Seconds - mean ± SD.

Subjects with high and low lead levels accepted for neuropsychologic evaluation in this study are an unbiased sample of children with lead burdens of this order in their communities. Subjects tested in this study do not differ in gender, prevalence of elevated dentine lead levels or classroom behavior from those excluded.

The problem of potentially confounding variables was handled by comparison of subjects on a large number of variables and by control, in the biostatistical analysis, for those differing between samples. Groups with high and low lead levels who were evaluated in this study were remarkably alike in most of the 39 non-lead variables measured, and only differed at P<0.05 on three variables: fathers' education, fathers' socioeconomic status and subjects' age at time of testing.

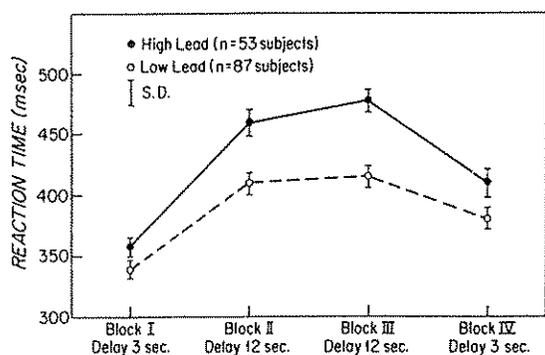


Figure 3. Reaction Time under Varying Intervals of Delay. "Delay 3 sec." indicates a three-second period between a warning signal (the spoken word, "ready") and the onset stimulus. Each subject received six trials in each block.

In this study, outcome measures that appear to be most sensitive to lead effects are those evaluating verbal and auditory processing, attention (as measured by reaction time) and classroom behavior. At the relatively low dose experienced by our exposed group, verbal and attentional processes appear most vulnerable.

Other investigators^{5,7} have reported that lead effects are most evident in the performance areas of the Wechsler Intelligence Scale for Children — Revised, and in perceptual and motor function. The differences in the expression of the effect of lead may reflect many factors, including magnitude and duration of exposure and age at time of exposure.

Reaction time under varying intervals of delay is one measure of the attentional process.²³ Needleman³¹ found that boys seven and eight years old with earlier blood lead levels higher than 50 μg per deciliter had longer reaction times at trial Blocks 2, 3 and 4 than controls whose earlier blood levels were less than 30 μg per deciliter. This replicated finding suggests that disturbances of attentional function are a consistent effect of lead exposure. The validity of this finding is further supported by the teachers' reports of increased distractibility, increased prevalence of daydreaming, lack of persistence, inability to follow directions and lack of organization in subjects with high lead levels. These behaviors are often found in children labeled as "hyperactive." Hyperactive behavior is a frequent sequel of frank lead poisoning,^{7,32} and is suspected of being an effect of lead at lower dose.³³ The items of hyperactivity and impulsivity, however, were reported relatively infrequently at all levels of dentine lead (Fig. 2). Although the frequency of these two behaviors is related to dentine lead burden, it appears that teachers in our study were reluctant to apply these labels to their students. The deficit of attention in the children with high lead levels demonstrated here may be responsible in part for impaired verbal learning.

The teachers' behavioral rating scale was found to be sensitive to the degree of lead exposure on almost all items across the entire range of dentine lead levels

in a dose-related fashion. This observation suggests that lead may increase the risk of undesirable behaviors in the classroom at doses considerably below those found in our group with high lead levels.

The defined "no-effect" levels for children exposed to lead has undergone a steady downward revision over the past three decades as new data have shown effects at lower doses. Currently, the Center for Disease Control has defined a blood lead level of 30 μg per deciliter as the threshold for undue lead absorption.² Among the reasons for this evolution in medical judgment has been the demonstration of the inhibitory effect of lead at extremely low concentrations on enzymes such as δ -aminolevulinic acid dehydratase³⁴ and brain adenylylase³⁵ and on mitochondrial function.³⁶ Piomelli³⁶ has recently reported that elevation of free erythrocyte protoporphyrin begins to occur in children at blood lead levels of 15 μg per deciliter. Although many investigators believe that alterations in free erythrocyte protoporphyrin, adenylylase, and δ -aminolevulinic acid dehydratase are among the first signs of impaired tissue function and therefore represent adverse health effects, it has been questioned whether at the lower levels of lead these alterations are health effects or merely biochemical events of little consequence.

The impaired function of children with high lead levels, demonstrated in the neuropsychologic laboratory, mirrored by disordered classroom behavior, appears to be an early adverse effect of exposure to lead. Permissible exposure levels of lead for children deserve re-examination in the light of these data.

We are indebted to Janice Adams, Margaret Nichols and Ruth Barrett, who performed the psychological tests, and to Lee Davidowski and Hamdi Maksoud, who analyzed the dentine specimens, to the teachers, principals and nurses of Somerville and Chelsea, Massachusetts, and to the late Dr. James Bryant, of the Somerville Board of Health, for help in the early days of the study.

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EPIDEMIC TOXOPLASMOSIS ASSOCIATED WITH INFECTED CATS

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Abstract In October, 1977, an outbreak of toxoplasmosis occurred in patrons of a riding stable in Atlanta, Georgia; 37 became ill with toxoplasmosis or had serologic evidence by indirect fluorescent-antibody test of acute infection with *Toxoplasma gondii* (titer $\geq 1:4096$ or a positive fluorescent-antibody test for toxoplasma antibodies). Forty-nine additional patrons did not become ill. Two of the three adult cats from the stable were seropositive for toxoplasma, which was also recovered from the tissues of two kittens and four

mice trapped near the stable. Patrons who spent most of their time at the end of the stable where a cat had defecated had the highest incidence of infection. Patrons who attended the stable daily had a higher attack rate than those who attended less frequently. No common meals were consumed, and dietary history eliminated meat as the source of infection. The data suggest that toxoplasma oocysts were the source of the infection. (*N Engl J Med* 300:695-699, 1979)

BOTH infection and disease are well documented for persons who have consumed toxoplasma in raw or inadequately cooked meat.^{1,2} More recently, the role of cats shedding toxoplasma oocysts as a source of human and animal infection has been widely publicized.³ Although most investigators acknowledge that oocysts are probably infectious for human beings, there is little evidence linking infection by oocysts with clinical disease in human beings.⁴

BACKGROUND

On November 11, 1977, a physician in Atlanta, Georgia, informed us about a patient with high fever and headache whom he had recently diagnosed as having toxoplasmosis. This patient informed us that she was aware of several people with similar symptoms who had all attended one local horseback-riding stable. We obtained serum from eight of those patrons, and all of them had high toxoplasmosis titers. This finding prompted a more thorough investigation.

The stable (Stable 1), located in DeKalb County, Georgia, consists of a 26-ha (65-acre) pasture, an outdoor riding arena and a 70-stall barn with a large indoor riding arena. The floor of the indoor arena is covered with a fine silt, which is watered and dragged as needed and occasionally bulldozed. The last bulldozing had occurred on September 3, 1977. The indoor arena was extensively used by pupils and instructors of a riding school, and most patrons visited the stable frequently.

METHODS AND RESULTS

Within a three-week period we interviewed all patrons of Stable 1, using a standardized questionnaire, and, when possible, serum specimens were obtained. Respondents were questioned about personal illness, illness of family contacts, activities at the stable, eating habits and exposure to cats.

From the Parasitic Diseases Division, Bureau of Epidemiology, and the Parasitology Division, Bureau of Laboratories, Center for Disease Control, Public Health Service, U.S. Department of Health, Education, and Welfare, the Department of Veterinary Science, Montana State University, Bozeman, MT, College of Veterinary Medicine, Ohio State University, Columbus, and the Epidemiology Section, Division of Physical Health, Georgia Department of Human Resources, Atlanta (address reprint requests to Dr. Teutsch at the Parasitic Diseases Division, Bureau of Epidemiology, Center for Disease Control, Atlanta, GA 30333).

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Environmental Assessment and Risk Analysis Element



Research Project Summary



May, 2003

Cultural Uses of Mercury in New Jersey

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Abstract

This study has two components:

1. Interviews with practitioners of Santeria and related practices
2. Survey of air mercury levels in buildings located in Hudson County.

Twenty-two Santeria "priests" (i.e., Santeros), practitioners and/or botanica owners in Hudson County, NJ, were interviewed to determine their knowledge and use of mercury. Of the 21 interviewed, 17 used mercury in some form. All the interviewees, however, denied recommending or endorsing sprinkling of mercury or recommending that clients use mercury on their own. This, however, does not preclude independent, or more cultural uses of mercury by individuals. While initial indications pointed toward Caribbean and/or Afro-Cuban mercury-related practices, seven of those using mercury in rituals were from Mexico, Central America, or South America. In addition, anecdotal information from interviewees suggests that informal practices with mercury may specifically be part of Dominican cultural practices. Measurements of mercury concentration in air were obtained in the hallways of 34, and in the entrance vestibules of an additional 33 multi-family apartment buildings in Union City and West New York (Hudson County), NJ, using a highly sensitive Lumex portable mercury analyzer. Comparison buildings in Montclair, NJ, were also analyzed. In Hudson County the maximum building hallway concentration (as a possible indicator of mercury use in apartments) was significantly greater than the mean outdoor concentration in 38% of the surveyed buildings. In two buildings the maximum hallway concentration exceeded the U.S.EPA's Reference Concentration (RfC) guideline of 300 ng/m³ although levels were significantly decreased on subsequent visits. Elevated hallway levels appear to result from specific apartments. These results suggest higher concentrations of mercury vapor in apartments. These results are consistent with intentional mercury use inside at least some of the buildings surveyed, but may also be consistent with recent data on indoor background levels resulting from historic spills.

Introduction

Anecdotal reports and small-scale observations over the course of the last decade in the New York City metropolitan area, Chicago, and elsewhere have suggested that mercury (Hg), particularly elemental mercury (Hg⁰) is used in certain cultural, folk, and religious practices. These have centered on Caribbean and Latin American populations, and appear to be linked to the Afro-Caribbean practice of Santeria, and related magico-religious practices. The reports suggested that uses of elemental mercury included amulets, sprinkling in cars, on household surfaces, and on and around newborns. Such uses could result in indoor air levels of mercury that pose a health hazard. Mercury droplets embedded in and adsorbed to household materials and surfaces could provide a long-term source of exposure which would be difficult to remediate. These studies have identified

botanicas as a major source for mercury in these practices. Mercury from botanicas appears to be sold typically in gelatin capsules. Laboratory measurement and modeling conducted in earlier research by one of the investigators (Riley) suggested that sprinkling of the contents of a typical capsule could result in household mercury concentrations in air which exceed the Agency for Toxic Substances Disease Registry's (ATSDR) minimal risk level (MRL) of 200 ng/m³. Little information has, however, been reported on the extent of cultural mercury use, the characteristics of its use, or the demographics of the users. This study was designed to provide preliminary information to aid in assessing the potential for an environmental health problem resulting from cultural use of mercury in NJ. The study had two components: 1. To conduct interviews with parishioners of Santeria (through a collaborating Santeria

priest, a Santero) to elicit information on whether and how mercury is used in Santeria, and 2. To survey mercury vapor levels in hallways and vestibules of apartment buildings in Hispanic areas of NJ to detect evidence of possible residential mercury use.

Methods

Interview Study

With the assistance of one of the investigators (Leal), who is, himself, a Santero (Santeria priest), contact was made with Santeros and other practitioners of Santeria in Hudson County, NJ. That this investigator was initiated into the generally secret rites of this practice, facilitated relatively open exchange of information in an otherwise secretive environment. Interviewees were questioned about their extent of initiation into the practices, their use of mercury in their religious practices, and about "prescription" of mercury in the rituals performed for their clients. Interviewees were also questioned about their knowledge of the hazards of mercury. Interviewees who were also botanica owners/employees were questioned about the sale of mercury in their establishments.

Mercury Vapor Monitoring Survey

The Mercury Vapor Monitoring Survey was intended as a method of screening buildings for possible residential mercury uses. Since mercury vapor concentrations were measured only in hallways and vestibules, the values obtained do not relate directly to exposure or health risk. Rather they are intended only to provide a semi-quantitative indication of indoor mercury use. Apartment buildings in Union and West New York (Hudson County), NJ, were selected on the basis of their location within 1/2 mile of a botanica. Real-time mercury vapor concentration measurements were made using a Lumex portable mercury vapor spectrometer with a sensitivity of 2 ng/m³. In buildings with interior access, mercury air concentrations were measured at multiple locations in the hallways on each floor of the building. In buildings without interior access, mercury air concentrations were measured in the entrance vestibule. Each reported reading was generated as the average of three 10-second measurements at sampling location. Attempts were made to localize elevated hallway mercury concentrations to the doors of specific apartments. No access into apartments was attempted. The number of units in each building was recorded, and data was subsequently obtained on the age of the buildings. Two buildings in Montclair, an area with little Hispanic/Latino population, were selected for comparison monitoring.

Results and Discussion

Interview Study

Table 1 provides a brief description of the 22 practitioners of Santeria and related practices interviewed in the study. It is interesting to note that 32% of those interviewed were from areas other than the Caribbean (Mexico and South America). About half of these practitioners said that they used mercury in their practice of Santeria and related rituals. This suggests that the cultural use of mercury may extend to groups beyond the Caribbean and Afro-Cuban communities. Mercury use was reported by 77% of the interviewees. Nonetheless, the interviewees reported that they do not

Table 1. Interview Summary Table

Respondent	Date 2001	Sex	Race/Ethnic Background	Status in Religion	Botanica Owner*	Azogue (Mercury Use)
1	3-Dec	Female	Brazilian	Espiritista	own shop	Yes
2	5-Dec	Female	Mexican	none	Employee	No**
3	5-Dec	Female	Cuban	Santera	Yes	Yes
4	6-Dec	Male	Afro-Cuban	Babalao	No	Yes
5	6-Dec	Female	Afro-Cuban	Santera	Yes	Yes
6	6-Dec	Male	Afro-Cuban	Babalao	No	Yes
7	7-Dec	Male	Peruvian	Babalao	No	Yes
8	7-Dec	Female	Afro-Cuban	Santera	No	Yes
9	7-Dec	Female	Dominican	Santera	Yes	Yes
10	7-Dec	Male	Mexican	Santero	Yes	Yes
11	8-Dec	Male	Ecuadorian	Practitioner	No	No**
12	8-Dec	Male	Dominican	Practitioner	No	No**
13	10-Dec	Male	Peruvian	Practitioner	No	No
14	11-Dec	Female	Columbian	Santera	Yes	Yes
15	11-Dec	Female	Cuban	Practitioner	No	Don't know
16	11-Dec	Female	Dominican	Santera	Yes	Yes
17	11-Dec	Female	Cuban	Santera	Yes	Yes
18	12-Dec	Female	Afro-Cuban	Santera	No	Yes
19	12-Dec	Male	Cuban-American	Santero	Yes	Yes
20	13-Dec	Male	Columbian	Palero	No	Yes
21	14-Dec	Male	Afro-Cuban	Santero	Yes	Yes
22	14-Dec	Female	Afro-Puerto Rican	Espirista	Yes	Yes

*If a botanica is run by a husband and wife and both were interviewed, both will be designated as botanica owners in this category. Respondent number one owns her own spiritual consulting shop, but this is not a botanica.

**Respondent does not use azogue but has sold it in his/her place of employment "prescribe" mercury for clients to use on their own. Rather, they conduct the rituals themselves for their clients with small amounts of mercury. This appears to be rooted in issues of compensation and of secrecy. The money paid to the Santeros is for conducting the rituals rather than for advice about what rituals to perform, and the details of the rituals are not disclosed to the clients. The interviewees expressed surprise at accounts of sprinkling, or "burning" mercury in households. Some interviewees attributed such practices to Dominicans, Puerto Ricans, Mexicans, Brazilians, and/or Nigerians. One specific anecdotal report related information that such practices had originated in Haiti, and been adopted by Dominicans. One of the investigators spent time in Cuba on an unrelated grant in 2002 conducting research on Santeria and Palero practices. She reported that none of the practitioners interviewed there had heard of sprinkling or "burning" mercury, or of mixing mercury with bathwater or personal products. Thus, it appears that while some mercury use is involved in the formal practices of Santeria, if indiscriminant use is occurring, it may be linked to more informal and broadly cultural practices. Despite some apparent degree of caution in handling mercury, the interviewees were generally unaware of the hazards of mercury. In addition, there is a general notion in this community that mercury is an illegal substance. This makes information gathering difficult and poses problems for outreach.

Mercury Vapor Monitoring Survey

Outdoor mercury vapor concentrations averaged 5 ng/m³

Table 2. Mean and Maximum Mercury Vapor Concentration in Interior Hallways

ID	Bldg Mean (ng/m ³)	Bldg Max(ng/m ³)	ID	Bldg Mean (ng/m ³)	Bldg Max(ng/m ³)
101	14	35	118	4	4
102	299	2022	119	10	12
103	1	2	120	10	11
104	4	20	121	107	774
105	59	82	122	12	13
106	2	6	123	2	4
107	1	3	124	20	22
108	9	10	125	14	17
109	3	5	126	7	9
110	73	129	127	9	12
111	1	4	128	26	32
112	17	20	129	12	14
113	15	19	130	13	15
114	12	14	131	9	16
115	9	13	132	13	45
116	7	10	133	6	7
117	11	12	134	33	52

with a 95th percentile of 21 ng/m³, and a maximum of 26 ng/m³. These values are consistent with levels generally reported in urban areas. Table 2 presents a summary of the mercury vapor concentration in interior hallways of buildings in Union City and West New York. The average mercury vapor concentration for the 34 buildings with access to interior hallways was 25 ng/m³. This value is, however, skewed upward by a few buildings with markedly elevated concentrations. In 38% of the buildings, the maximum hallway concentration significantly exceeded the outdoor concentration (> mean outdoor concentration + 2 standard deviations). In two buildings, the maximum hallway concentrations were 155 and 400 times the average outdoor concentration. In both cases the indoor concentrations exceeded the U.S.EPA's Reference Concentration (RfC) guideline of 300 ng/m³. Elevated hallway mercury concentrations were generally traceable to the doorways of individual apartments. In the two buildings with the highest hallway concentrations, there appears to be a clear indication of a mercury spill or uncontrolled mercury use inside apartments. In five other buildings whose maximum hallway concentrations were larger than the maximum outdoor concentrations, there is a suspicion of mercury use or spillage in apartments. Subsequent sampling visits were made to the buildings with the two highest mercury concentrations. Given the tendency of spilled mercury droplets to continue to volatilize over long periods of time, it is surprising that these highest concentrations varied considerably, declining on some visits by a factor of more than 140. In the building with the largest number of follow-up visits (6), the levels declined and rose, but remained significantly elevated on most visits. The reason for this variability is not clear, but may be a function of ventilation. In 33 buildings with access to entrance vestibules only, the mean mercury concentration was 8 ng/m³, and the maximum concentration was 29 ng/m³. These values are difficult to interpret, but at least some buildings had vestibule concentrations which exceeded the maximum outdoor level. In two comparison buildings in

Montclair, NJ, the mean mercury hallway concentrations were 5 and 24 ng/m³, and the maximum concentration was 36 ng/m³. It was later reported that a "shaman" lived in the building with the maximum concentration. The significance of this is unclear.

It seems clear that there are significantly elevated indoor mercury concentrations in at least some of the buildings surveyed in Hudson County in areas anecdotally associated with cultural mercury use. A recent report of mercury vapor levels inside 12 New York City apartments selected without reference to possible mercury use detected a maximum concentration of 522 ng/m³, and two apartments with concentrations >50 ng/m³. There was no evidence of intentional mercury use, and in some locations, historical thermometer breakage was reported (Carpi and Chen, 2001). Levels measured inside living spaces cannot be easily compared to levels measured in hallways. However, comparison of the findings in the current study to those of Carpi and Chen (2001) suggests that the highest concentration found in the hallways in the current study may be consistent both with intentional (i.e., cultural) mercury use, and with unintentional breakage of mercury-containing appliances.

Recommendations

1. Additional indoor air sampling is warranted to better characterize mercury levels in apartments. Comparable sampling in areas with different ethnic characteristics is needed to better understand the relative contributions of intentional/cultural mercury use, and unintentional mercury appliance breakage.
2. A better understanding of cultural mercury uses in specific ethnic communities in Hudson County including, but not limited to, the Dominican community is important in order to target outreach efforts.
3. An educational effort aimed at those who sell mercury, recommend its use, and/or use it themselves is needed in order to ensure that the potential for a significant public health problem is minimized.

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RESEARCH PROJECT SUMMARY

Division of Science, Research and Technology

Research Project Summary

September, 2007

Cultural Uses of Mercury in New Jersey – Year 2 Mercury Vapor in Residential Buildings – Comparison of Communities That Use Mercury for Cultural Purposes with a Reference Community

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Abstract

The first year of this study compared levels of mercury (Hg) vapor in hallways and common areas of apartment buildings in West New York, New Jersey and Union City, New Jersey to outdoor levels (Garetano et al. 2006). These two communities were chosen based on the prevalence of botanicas that sold Hg for cultural uses (e.g., Santeria and related practices). The results from the first year's study suggested that levels of mercury in apartment buildings in these areas were significantly elevated above outdoor levels. However, these results could not distinguish between intentional cultural use and unintentional spills from household mercury-containing devices such as thermometers. In the second year of this study, the researchers increased the number of buildings sampled in West New York and Union City (the study communities), and compared the Hg vapor levels in these buildings to levels in a reference community with comparable housing stock, but no evidence of cultural use of Hg. There was no difference between the outdoor Hg levels in the study communities versus the reference community (2.9 vs. 2.3 ng/m³; p=0.20). However, compared with the reference community, public spaces in buildings in the study communities had significantly higher mean Hg levels (9.8 vs. 5.0 ng/m³; p=0.03) and higher average maximum values (13.3 vs. 6.4 ng/m³; p=0.01). Comparison of levels in the reference community to outdoor levels suggests an elevated background of indoor Hg vapor possibly from a history of unintentional Hg spills. However, the significantly increased levels above this background that were observed in the study communities strongly suggest (but do not prove) the prevalence of intentional cultural use of Hg. These findings call attention to the potential for significant exposure in areas with likely cultural use of Hg.

Introduction

Based on the first year of this study it was clear that elemental mercury (Hg) was used in some portion of the Hispanic community of New Jersey in cultural practices such as Santeria, and perhaps to a greater extent, in less formal folk practices (Gochfeld et al. 2002). For the study communities of West New York and Union City, this was reflected in the number of botanicas selling mercury. Given suspicion of outsiders and cultural sensitivities in these communities, direct measurement of Hg vapor levels in residences was not considered feasible. As an alternative approach, Hg vapor was measured in common areas of apartment buildings (hallways, vestibules). Such measurements can provide a signal of residential Hg exposure in apartments, but do not provide direct information on levels of exposure. During the first year of this study, Hg vapor levels in common areas of apartment buildings were compared to building-specific outdoor levels (Garetano et al. 2006). Results from the first year were consistent with cultural use of Hg in a significant proportion of buildings in the study area, but were also consistent with unintentional spills of Hg (Carpi and Chen 2001). Therefore, the second year of this study was designed to compare the levels of Hg vapor in comparable buildings in the study communities and a reference community that does not have an ethnic profile likely to be associated with cultural use of Hg,

and consistent with this, does not have botanicas.

Methods

As in the first year of this study, because of suspicion of outsiders and cultural sensitivities, it was not feasible to sample Hg levels in air inside residences. Therefore, the same approach of measuring Hg vapor levels in building hallways was used in the second year. This approach is not intended to measure exposure, but instead, is intended to identify a signal of elevated Hg levels in residences by the appearance of Hg vapor in the hallways outside the residences. Hg vapor was measured using a highly sensitive and portable direct-reading instrument with a detection limit of 2 ng/m³. As in the first year study, the study communities were West New York and Union City, New Jersey. The reference community, Montclair, is located 16 km from the study communities, and was determined to have apartment buildings of similar age and construction. Based on the absence of botanicas and the low Hispanic population, cultural use of mercury was considered unlikely in this area. Buildings in each area were selected at random. In the study area, 62 buildings were monitored, and in the reference area, 38 buildings were monitored. Buildings selected for monitoring had at least three floors. Hg vapor levels were surveyed in multiple locations on each floor, and

at least one location on each floor and each wing of a floor was chosen as representative of that area. In addition, areas with notably elevated Hg levels were also selected for monitoring. Results from each sampling location were reported as the mean of three, ten-second real-time measurements. Results were reported as building-wide mean levels and building maximum levels. Relative ventilation rates were estimated based on CO₂ air concentrations.

Results

Ventilation rates were similar in buildings in the study and reference areas, and did not account for differences in Hg vapor concentrations. Likewise, temperature did not differ significantly between the two areas. Outdoor Hg vapor levels (< 3.0 ng/m³) did not differ significantly between the study and reference areas. In both areas, indoor levels were significantly greater than outdoor levels. Mean building levels were significantly greater in the study area (9.8 ng/m³ +/- 11.3) compared to the reference area (5.0 ng/m³ +/- 3.0). Likewise, the mean of building maximum levels in the study area (13.3 ng/m³ +/- 14.9) were greater than the mean building maximum level in the reference area (6.4 ng/m³ +/- 4.1). In the study area, 19 of the 62 monitored buildings (31%) had maximum Hg levels that exceeded the top fifth of all maximum building results. In contrast, only 1 of the 38 monitored buildings in the reference area (3%) had a maximum Hg level in the top fifth of overall maximum levels. A similar contrast between the maximum levels in the study and reference areas was observed when the 90th percentile of all maximum levels was used as the basis of comparison. However, in comparing Hg vapor levels in the study and reference areas to outdoor levels, it was found that there was no significant difference in the proportion of buildings in the study area (37%) and reference area (47%) that exceeded the 95th percentile of outdoor Hg vapor concentrations. This indicates that compared to outdoor levels, there is a significant background level of indoor Hg vapor that appears to be independent of cultural use. Neither the presence of fluorescent bulbs in common areas, nor spills from basement gas meters appeared to explain these observations.

Discussions and Conclusions

Although none of the buildings monitored in the study location in the second year of the study were the same as the buildings monitored in the first year of the study, the results of the second year study are highly comparable to those from the first year, with 35% and 37% of the buildings in the first and second year, respectively, exceeding the 95th percentile of outdoor levels of Hg vapor. This provides confidence that the results from both years are representative of the study area. The observation that 47% of the buildings in the reference area, where cultural use of Hg is considered unlikely, also exceeded the 95th percentile of outdoor levels indicates that, independent of cultural use, there are significant background sources of indoor Hg. While we have no direct information on the nature of such sources, they seem to be consistent with

unintentional spills of mercury from household appliances including thermometers (Carpi and Chen, 2001). However, taking this background level of Hg vapor into account, it is still clear that the study area differs from the reference area with respect to the maximum building levels of Hg that were measured. Buildings in the study area were highly disproportionately represented among the highest of the measured maximum levels. In fact, the only building in the reference area that occurred among those in the top 20% of maximum building levels was a building in which a specific Hg spill was discovered in a common area. While these observations cannot prove that this difference between the study and reference areas results from cultural uses of Hg in the study area, they are highly suggestive of such uses. Furthermore, having eliminated other obvious possible sources of Hg vapor as explanations, there do not appear to be other likely explanations for these results. Although none of the measured levels in common areas exceeded standards or guidelines for environmental exposure, these common areas are not representative of the residential areas in which exposure is likely. These measurements represent only a signal of exposure and exposure cannot be estimated from these data. Nonetheless, it is reasonable to assume that exposure levels in the actual residential spaces (i.e., apartments) exceed those measured in the common areas. These results point to the need for the development of a public health policy to reduce exposures resulting from cultural use of Hg.

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RESEARCH PROJECT SUMMARY

HIDDEN DANGER: *Environmental Health Threats in the Latino Community*

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EXECUTIVE SUMMARY

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MERCURY EXPOSURE

The harmful effects of mercury pose another health threat to Latinos. The major ways in which Latinos are exposed to mercury are by eating mercury-contaminated fish and by using mercury in religious ceremonies, cosmetics, and folk remedies.

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Certain religious and cultural practices provide another route of exposure to mercury, which is sprinkled indoors by practitioners of *Espiritismo* and *Santeria* (religious traditions found most commonly among people of Puerto Rican and Cuban origin, respectively), and in the *Voodoo* and *Palo* traditions. Surveys in Massachusetts, New York, and Chicago found that between 19 and 44 percent of Hispanic respondents reported using mercury for magic or religious purposes. Researchers estimate that 47,000 capsules of mercury are sold per year in *botanicas* (stores that sell remedies and religious items) in [the borough of the Bronx] New York City, and these capsules are likely to cause long-term contamination of more than 13,000 homes or apartment buildings each year. Use of mercury in an apartment building has been shown to cause elevated levels of mercury vapor in the hallways and entryway, and probably also in other apartments where mercury is not used. Toxic vapors can linger for months or even years, leading to neurological and respiratory symptoms in apartment residents.

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Chapter 6

MERCURY

Another substance posing a significant health threat to Latinos is mercury. Once known best as the silvery liquid in thermometers, mercury is better known today as a poison that damages the brain and kidneys. Despite the health risks associated with the chemical, the public largely does not appreciate the seriousness of the threat and the presence of its sources. This is especially true in the Latino community, where public education efforts in Spanish have so far been limited. The most serious ways in which Latinos may be exposed to dangerous amounts of mercury are eating mercury-contaminated fish and using mercury in religious ceremonies, cosmetics, and folk remedies.

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MERCURY LEVELS IN THE BLOOD AND HAIR OF LATINOS

Nationwide, more than one in 12 women of reproductive age has mercury in her blood that exceeds the level set as safe by the Environmental Protection Agency (EPA).⁴ A large study done by the Centers for Disease Control and Prevention (CDC) tested for mercury in the blood and hair of more than 2,500 women and children around the United States. On average, Mexican-American children had higher levels of mercury in their bodies compared with non-Hispanic white children.⁵ In addition, three people tested in that study had mercury levels that were 100 to 1,000 times as high as the average for the other people tested. All of these people were Mexican-Americans, including a 37-year-old woman and two children ages 1 and 3. These people had both methyl mercury and inorganic mercury in their bodies, suggesting that they may have been exposed to this toxic chemical both from eating fish and from direct exposure such as from folk remedies or religious uses.

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FOLK REMEDIES AND COSMETICS

Mercury, known as *azogue* in some Latino communities, is sometimes used as a folk remedy for *empacho* (indigestion or gastroenteritis). This practice is most common among Mexican-Americans, and surveys have found that one out of 12 Latinos in New Mexico mention *azogue* as a cure for *empacho*.¹⁵ Doctors have [p. 58] documented individual cases of children becoming ill, even requiring hospitalization, from the use of mercury for *empacho*.¹⁶ Not surprisingly, children are more likely than adults to be harmed by ingesting *azogue*.¹⁷ Diagnosis is complicated by the similarity between the symptoms from consuming *azogue* and the symptoms of the illness it is used to treat. People who use *azogue* for the treatment of illness do not realize that it is harmful, just as most Americans did not realize until recently the potential hazards of mercury-containing disinfectants (such as Merthiolate or Mercurochrome) for treating cuts and scrapes in children.

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RELIGIOUS CEREMONIES

Another source of mercury exposure that goes largely unnoticed is its use in the religious practices of some Latin American and Afro-Caribbean communities. Practitioners of *Espiritismo* and *Santeria* (religious traditions most commonly found among people of Puerto Rican and Cuban origin, respectively), *Voodoo*, and *Palo* use mercury. It is sometimes carried in capsules, burned in candles or oil lamps, sprinkled around the home, or added to perfumes. In these religious traditions, *azogue* helps summon spirits for magical spells and serves as an amulet that keeps evil spirits at bay and brings good luck.²⁰

Initial studies indicate that the use of *azogue* is relatively common in the Latino and Caribbean community. A 2003 study of 898 Latino respondents in [Lawrence] Massachusetts found that 38 percent have used or know someone who has used *azogue* for religious, spiritual, or health purposes.²¹ Similarly, a study of 203 adults in New York City revealed that 44 percent of Caribbean respondents and 27 percent of those from Latin America reported using mercury as a part of their cultural practices.²² In a Chicago survey, 19 percent of Hispanics reported using mercury for magic or religious purposes.²³ And in another survey, 12 percent of practitioners reported sprinkling mercury around a child's crib or bed.²⁴

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Mercury is sold in most *botanicas*, stores that sell remedies and religious items. Studies show that more than 85 percent of *botanicas* around the country sell *azogue* and that in some areas the percentage is even higher.²⁵ A canvass of 35 *botanicas* in the Bronx found that they collectively sold more than 420 kilograms (924 pounds) of mercury yearly.²⁶ Based on this survey, researchers estimated that 47,000 capsules of mercury are sold per year in [the Bronx,] New York City, and these capsules would be likely to cause long-term contamination of more than 13,000 homes or apartment buildings each year.²⁷

Even if a family does not use mercury themselves, there can be a danger of exposure because mercury lingers in cracks in the floor or in carpets for months or years, slowly giving off mercury vapor that

can be inhaled by people living in the building. For example, use of mercury in an apartment building has been shown to cause elevated levels of mercury vapor in the hallways and entryway, and probably in other apartments where mercury was not used. Moving into a house or apartment where mercury was used in the past can expose new occupants to mercury hazards. Children have been reported to become seriously ill from living in a room where a mercury thermometer was broken eight months previously, and the amounts of mercury used in these rituals can be significantly more than the amount in a thermometer.²⁸ In certain areas of New Jersey with large populations of Caribbean-Americans, indoor mercury levels have often been found to be five times the outdoor level.²⁹ When mercury is in vapor form it can cause neurological problems and is also associated with respiratory symptoms such as shortness of breath, pneumonia, and lung disease.³⁰

In 2001, the New York State Senate adopted a resolution calling on state and federal agencies to investigate the residential use of mercury in New York. The Senate was especially concerned about the risks to women and children and about the risks to people who move into apartments unaware that the previous tenant scattered mercury that could make them sick.³¹ In 1994, the U.S. Environmental Agency warned state and local health officials of a mercury threat to Hispanics related to the use of mercury in many Hispanic communities.³²

Studies have shown elevated levels of mercury in people's bodies related to inadvertent exposure to mercury used in rituals. A survey of 100 Hispanic and Caribbean children from a Bronx, New York, community with known access to mercury for religious rituals revealed that 5 percent had elevated levels of the toxic metal in their urine.³³ The mercury levels were as high as those shown to cause subtle cognitive defects, abnormalities in motor function, and mood changes in adults. Recently, health officials investigating a mercury spill in a school found that Latinos who used mercury in their homes had higher mercury levels than individuals exposed at the school.³⁴

Mercury disposal is also cause for concern. A 1999 study showed that 64 percent of users of *azogue* reported throwing mercury into the garbage, and 27 percent reported flushing it down the toilet.³⁵ New York's Bureau of Wastewater Treatment has been unable to identify the source of about 68 pounds per year of mercury entering one of its plants from a region that contains the city's largest Latino population.³⁶ When mercury is disposed of in garbage or wastewater, it eventually is transformed into methyl mercury and contaminates the fish we eat.

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Conversations with *azogue* users indicate that some realize that touching or eating mercury may be harmful, but they are generally unaware that mercury is highly volatile and that inhalation is a very dangerous route of mercury exposure.³⁷ A culturally sensitive education campaign that involves *Santeros* (*Santeria* priests), local groups, and local government officials could address this problem. Significantly, various studies show that *botanica* owners are already wary of outsiders and are trying to conduct sales in an inconspicuous manner. Any action that drives this business further underground will only hinder efforts at education. Therefore, an approach that allows practitioners to make well-informed decisions will help to protect children in these communities.

RECOMMENDATIONS

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- Local departments of health in cities with significant Latino populations should provide bilingual materials at public health clinics and in schools to inform Latinos about the risks of mercury use in folk remedies, cosmetics, and religious ceremonies.

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Azogue Vidajan Metallic Mercury Poisoning



THE CITY OF NEW YORK
DEPARTMENT OF HEALTH

Rudolph W. Giuliani
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Neal L. Cohen, M.D.
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Web Site: www.ci.nyc.ny.us/health

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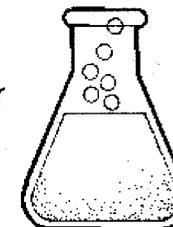
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What is Azogue/Vidajan?

Azogue is Spanish and *Vidajan* is Haitian Creole for metallic mercury also known as *quicksilver* in English.

Metallic mercury is a very toxic, silver-gray liquid metal.

- ◆ It does not dissolve in water or alcohol.
- ◆ It has no smell but has a metallic taste.
- ◆ It can be a liquid or a vapor at room temperature.
- ◆ It can remain where spilled for several months.
- ◆ It evaporates in air.
- ◆ Its vapors cannot be seen.



ALL TYPES OF MERCURY ARE TOXIC.

Azogue/Vidajan is found in thermometers used to measure body temperature, some paints (made before 1991), electrical switches, thermostats and batteries. It is also sold in botánicas in capsules in amounts ranging from a few grams to 3-5 ounces for spiritual "works" (*trabajos*).



An *azogue/vidajan* capsule can contain up to 10 times more mercury than one thermometer.

The mercury vapor from these capsules is heavier than air, so the vapor tends to settle near the floor. **Children may be at a greater risk** of breathing in the vapor, because they may crawl and play on floors.

WHAT IS AZOGUE/VIDAJAN USED FOR?

Some people use *azogue/vidajan* in traditional medicine or for spiritual/religious purposes, such as:

- ◆ to cleanse or protect the home
- ◆ to cure stomach ailments
- ◆ for spiritual cleansing
- ◆ for protection and to increase good fortune
- ◆ to offer petitions to the Yoruba gods
- ◆ for love spells

When used for spiritual/religious purposes, *azogue/vidajan* has been:

- ◆ placed in floor washes or sprinkled onto the floor
- ◆ applied to the skin or used in baths
- ◆ swallowed
- ◆ placed in oil lamps or candles
- ◆ kept inside vials or charm bags as amulets



IS THERE A SAFE WAY TO USE AZOGUE/VIDAJAN?

NO! There is always a risk of breathing *azogue* vapors when it is used in any way.

→ *Azogue/Vidajan* is dangerous when inhaled. It can also be harmful when swallowed or applied to the skin.

→ *Azogue/Vidajan* gets into carpets, draperies, furniture, and cracks in the floors when spilled. It can stay in a room for months or years.

→ You won't know how often you are breathing *azogue/vidajan* vapor because you cannot see or smell it.



HOW CAN *AZOGUE/VIDAJAN* AFFECT YOUR HEALTH?

- *Azogue/Vidajan* can stay in your kidneys and brain for months. The most affected part of the body is the nervous system.
- *Azogue/Vidajan* can cause permanent damage to the brain and kidneys. It can harm the developing baby, and may even cause death.
- The health effects depend on how much and for how long a person has had contact with *azogue/vidajan*.

Signs and Symptoms of *Azogue/Vidajan* (Metallic Mercury) Poisoning :

- ◆ tremors
- ◆ irritability and shyness
- ◆ redness and swelling of the mouth and gums
- ◆ memory loss
- ◆ headache
- ◆ tiredness and difficulty sleeping
- ◆ depression
- ◆ loss of appetite and weight loss
- ◆ eye and skin irritation
- ◆ respiratory failure and death (after very high exposures)

→ It may take a long time for signs and symptoms to develop. For this reason, poisoning may be difficult to diagnose.

→ Tell your doctor if you experience any of these signs and symptoms. Also let your doctor know if you use *azogue/vidajan* (metallic mercury).



Health Effects on Children

***Azogue/Vidajan* is most dangerous to the unborn child and small children.**



Vapors breathed in by pregnant women can enter the developing baby. *Azogue/vidajan* can also be passed to an infant through the mother's breast milk.



Toddlers who crawl on floors where *azogue/vidajan* has been spread may breathe it in or may swallow it. This exposure can cause brain damage that may lead to behavioral and learning problems.

The younger the child, the greater the risk of long-term effects.

Children are more affected by mercury than adults. Some children exposed to *azogue/vidajan* can develop a condition called *acrodynia* or *pink disease*.

Signs and Symptoms of Acrodynia in Children:

- ◆ severe leg cramps
- ◆ irritability
- ◆ numbness, prickling or tingling
- ◆ painful pink fingers
- ◆ peeling hands, feet and nose
- ◆ rash
- ◆ heavy sweating
- ◆ sensitivity to light



WHAT CAN BE USED INSTEAD OF AZOGUE/VIDAJAN?

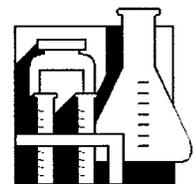
Botánicas have substitutes for *azogue/vidajan*.

Alternatives to *azogue/vidajan* can be found in books sold in botánicas. You can also ask an *espiritista*, *santero* or *doktè fey* to suggest other things that may be used in place of *azogue/vidajan*.

HOW TO MEASURE THE AMOUNT OF AZOGUE/VIDAJAN IN THE BODY OR HOME

The only way to know if there are *azogue/vidajan* vapors in the home is to test for it with special equipment, such as a mercury detector (mercury vapor analyzer) that measures the level of *azogue/vidajan* in the air in the home. For more information about mercury air testing, call the New York City Department of Health.

There are laboratory tests that measure the level of *azogue/vidajan* in urine and blood. A urine test is the best way to measure for exposure to



azogue/vidajan (metallic mercury). If you think you have been exposed and need testing, call your doctor or the New York City Department of Health.

HOW TO CLEAN UP AZOGUE/VIDAJAN

When *azogue/vidajan* is spilled, it breaks apart into tiny silver beads that roll around and stick to surfaces and get in cracks.



Do not use a vacuum cleaner, broom, or mop to collect spilled *azogue/vidajan*. Brooms and mops will spread the *azogue/vidajan* beads and a vacuum will heat the *azogue/vidajan*, causing it to give off DANGEROUS vapors.

Do not throw *azogue/vidajan* down sinks, toilets or bathtub drains. The *azogue/vidajan* may become trapped, then evaporate and re-enter the home.

Small amounts of *azogue/vidajan* (like the amount found in thermometers—about 4.5 grams)



can be cleaned up from surfaces like tile, wood, or linoleum floors. If *azogue/vidajan* has been spilled or placed on carpets, upholstery or other porous surfaces, throw them away if possible, or clean them using mercury spill kits and detergents.

Do not attempt to clean-up large amounts of mercury (more than the amount found in a fever thermometer) yourself.

Method for Clean-up of SMALL (less than 5 grams) amounts of spilled *azogue/vidajan* (metallic mercury).

- Keep children and pets away from the area before and during clean-up.
 - Remove gold jewelry. Mercury can damage gold items.
1. Have ready 4-5 sealable plastic bags (preferably ziplock), a trash bag, rubber or latex gloves, paper towels, cardboard or squeegee, an eyedropper, wide tape and a flashlight.

2. Put on rubber or latex gloves.
3. Carefully pick up any pieces of broken glass (from a thermometer or vial). Place them on a paper towel and put the towel in a zip lock bag to be thrown away.
4. Use stiff cardboard or a rubber squeegee to collect the silver beads in one place. (Use a flashlight to help you look for *azogue/vidajan* beads). Remember to look all around the area because the beads can stick to surfaces and get into cracks in the floor!
5. Use an eye dropper to carefully draw up the *azogue/vidajan* beads. Slowly squeeze the beads onto a damp paper towel. Put the towel in a zip lock bag to be sealed and thrown away.
6. Use the sticky side of wide tape to pick up any remaining glass and *azogue/vidajan* beads. When done, place the tape containing glass and *azogue/vidajan* into a zip lock bag.
7. When all visible pieces have been picked up and clean-up is done, place the cardboard or squeegee into a zip lock bag for disposal.

8. Carefully remove rubber gloves and place them in a zip lock bag.
9. Put the sealed zip locked bags in a sealed garbage bag and dispose with regular household trash.

→ If possible, open a window for 24 to 48 hours in the room where the *azogue/vidajan* was spilled to ventilate the area *after* the clean-up has been completed.

→ Do not vacuum area until 2-3 days after the clean-up. Make sure there are no beads of *azogue/vidajan* left before vacuuming! After this you may vacuum the area as needed.

It can be very difficult to completely remove *azogue/vidajan* beads that have made their way into cracked surfaces, such as wood, linoleum, ceramic or parquet floor tiles.

Mercury spill kits can be used to clean up spills. These kits are sold by safety equipment distributors, industrial safety supplies outlets, or laboratory safety services (check under *environmental and ecological products and services* or *laboratory safety services* in phone books).

If there is a large amount of mercury (more than the amount found in a fever thermometer) in your home or business and you want to dispose of it, the New York City Department of Environmental Protection (DEP) can recycle the mercury. Please call the Department of Environmental Protection during normal business hours (Monday through Friday, 9 AM to 5 PM) at 718-595-4784 to find out more about recycling mercury.

If a large amount of mercury has been spilled in your home or business, please call the New York City Department of Health Poison Control Center or the New York City Department of Environmental Protection.

**NYC Department of Health
Poison Control Center:
212-764-7667 (24 hours a day)**

**NYC Department Environmental Protection
718-DEP-HELP (24 hours a day)**

FOR MORE INFORMATION

If you have any questions about possible health effects from *azogue/vidajan* or how to clean up *azogue/vidajan* from your home, please call the New York City Department of Health.

If you have questions about the disposal of large amounts of mercury (more than the amount found in a fever thermometer), please call the New York City Department of Environmental Protection.

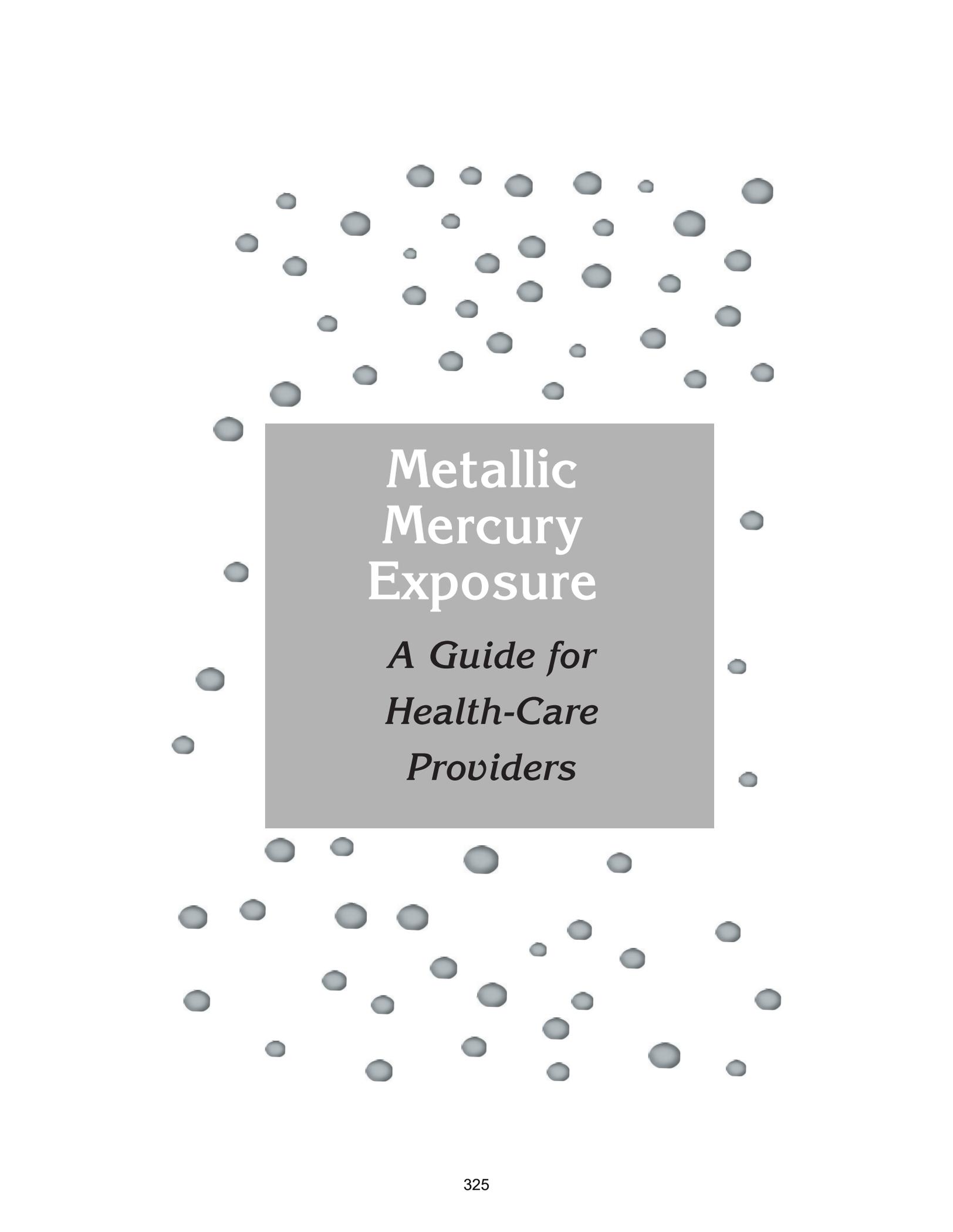
You can also talk to your doctor about *azogue/vidajan* and ask your *santero* or *espiritista* or *doktè fey* to suggest substitutes for *azogue/vidajan*.

NEW YORK CITY DEPARTMENT OF HEALTH
Bureau of Environmental and Occupational
Disease Prevention
Information on Health Effects and Clean-up of Mercury
125 Worth St., CN-34Cs
New York, NY 10013
(212) 788-4290 (Monday-Friday, 9 AM -5 PM)

NEW YORK CITY DEPARTMENT OF HEALTH
Poison Control Center
Information on Health Effects and Clean-up of Mercury
455 First Ave. CN-81
New York, NY 10016
(212) 764-7667 (24 hours a day)

NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL
PROTECTION
Department of Emergency Response and
Technical Assessment
Information on Mercury Recycling
(718) 595-4784 (Monday-Friday, 9 AM -5 PM)

To report a large mercury spill
(718) DEP-HELP (24 hours a day)



Metallic Mercury Exposure

*A Guide for
Health-Care
Providers*

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METALLIC MERCURY EXPOSURE

A Guide for Health-Care Providers

Some people in Latin American and Caribbean communities, especially those who practice Santería, Espiritismo, or Voodoo, may use metallic mercury (known as azogue or vidajan) in religious and ethnomedical rituals that could adversely affect their health. Some people may use metallic mercury in folk treatments as a substitute for, or as a supplement to, conventional medical treatment.

This brochure has been developed to inform health-care professionals and providers that their patients who use metallic mercury may be at risk for mercury poisoning. It addresses the most common questions and concerns about metallic mercury:

① What is Azogue / Vidajan? ② Reasons and Means of Use ③ Routes of Exposure ④ Health Effects ⑤ Testing for Exposure and Absorption ⑥ Removal and Disposal of Metallic Mercury ⑦ Legal Issues ⑧ Addressing Patient Concerns ⑨ Additional Resources

❶ WHAT IS AZOGUE / VIDAJAN?

Azogue / Vidajan is metallic mercury.

In the English and Spanish languages, quicksilver and azogue are popular names for metallic mercury. In Haitian Creole, metallic mercury is called vidajan.

Azogue / vidajan may be commonly found in *botánicas* and religious stores that sell popular religious and non-conventional medicinal products located in Latino and Caribbean communities.

Metallic mercury can be easily identified by its shiny, silver-gray appearance. This heavy and slippery liquid metal easily breaks up into many small beads, which can join again with equal ease. When dispersed in a room, it may not be easily seen and can remain for months or years.

Metallic mercury:

- ◆ does not dissolve in water or alcohol
- ◆ is odorless but has a metallic taste
- ◆ is a liquid and a vapor at room temperature
- ◆ evaporates slowly into indoor air (and evaporates more quickly as the temperature increases)
- ◆ is invisible in vapor form

There are other types of mercury besides the metallic form. Some people confuse the **silvery** metallic mercury with the **red** mercury called mercuric sulfide (Spanish *mercurio*). Mercuric sulfide (also called cinnabar) is used as pigments in paints and tattoos. Metallic mercury is refined to its elemental form from mercuric sulfide.

Metallic mercury is sold in *botánicas* in capsules or glass vials in amounts ranging from a few grams to 3 to 5 ounces for spiritual “works” (*trabajos*). It can also be found in thermometers, electrical switches, and thermostats in the home.

Azogue / Vidajan capsules can have up to 10 times (3 to 5 ounces) more metallic mercury than one thermometer.

Mercury Vapors

Metallic mercury begins evaporating as soon as it contacts air. Higher temperatures increase the rate and amount of evaporation. Since *azogue / vidajan* capsules are not sealed, there is always a risk of evaporation from the container. The vapor particles will stick to almost anything: jewelry, carpets, draperies, clothing, furniture and cracks in floors.

Metallic mercury vapors are invisible and may persist throughout the room for many months or years. Because mercury vapors can remain within indoor environments for extended periods of time, people who live in or regularly visit these households may be at risk for exposure to harmful levels of mercury vapor. The risk of exposure may be greater during cold seasons, when people heat their homes and close their windows, trapping heat (and mercury vapors) inside. Changes in temperature can cause fluctuations in the concentration of indoor mercury levels.

Mercury vapor is denser than air and settles near the floor. **Children are at a greater risk of exposure because they spend more time on the floor.** Younger children in particular can be exposed to more of the invisible vapors because they often crawl or play on the floor, and generally have higher respiration rates.

Ⓢ REASONS AND MEANS OF USE

Industrial Uses

In the past, metallic mercury was a common ingredient in pharmaceutical products, was used in industry to coat mirrors, and could be found in some paints (prior to 1991). Today, this liquid metal is found in electrical equipment (e.g., batteries), weather instruments (e.g., thermometers, barometers, manometers, switches), and dental amalgams. It is also used in factories to produce chlorine gas and in “informal” gold extraction as well as the industrial gold mining process.

Spiritual Uses

The use of *azogue* can vary widely among individuals. *Azogue* has particular significance in *Santería* or *Lucumí* religion. The metal “works” for *Eleggúá*, an African Yoruba god and one of the *Siete Potencias Africanas* (The Seven African Powers), called upon by believers to open paths and remove obstacles. *Azogue* is also one of the seven basic metals of *Santería*. It is believed that the metal *azogue* can give either *resguardo* (protection) or *cantazo* (a strike against a person, bringing harm and illness).

Espiritismo, also called “the work of the spirits,” is a traditional healing practice in which people maintain relationships with the “*protecciones*”—the *ángel guardian* (guardian angel) and *guías* (spirit guides).

Adherents believe that *azogue* has spiritual powers similar to its characteristics as a metal. Just as *azogue* moves quickly, likewise it “speeds” the “works” of *Santeros* and *Espiritistas*.

Practitioners of *Santería*, *Espiritismo*, or *Voodoo* may periodically use *azogue* or *vidajan* in practices to seek spiritual aid from the gods or spirits. It is used in a variety of ways for various reasons.

It may be:

- ◆ placed in floor washes or sprinkled directly onto the floor to cleanse or protect the home
- ◆ ingested to cure stomach ailments
- ◆ applied to the skin or used in baths for spiritual cleansing
- ◆ placed in oil lamps or candles for protection and to increase good fortune
- ◆ kept inside a vial or charm bag for protections or as amulets
- ◆ offered as petitions to the Yoruba gods
- ◆ used for love spells

③ ROUTES OF EXPOSURE

It is hazardous to use metallic mercury and breathe its vapors. There is always a risk of mercury intake whenever it is used.

Inhaling Mercury Vapors

Metallic mercury is harmful when ingested, but even **more dangerous** when inhaled. The vapors rapidly diffuse through the lungs and enter the bloodstream. The mercury is converted to different physical and chemical states, and distributed to tissues throughout the body. Almost 80% of inhaled metallic mercury vapor is absorbed by the body. The mercury accumulates in the kidneys and brain. Some of the inhaled mercury is exhaled, or released through urine or excrement.

Ingesting Mercury

Ingested metallic mercury is usually converted to a non-diffusible form that prevents it from easily entering the bloodstream. Most of it goes through the gastrointestinal tract and is expelled from the body through excrement. Less than 1% of ingested metallic mercury is absorbed by the body. About half of the mercury ingested will be excreted after 35 to 90 days. While in adults, ingesting small quantities of metallic mercury may not immediately result in noticeable health effects, the same amount of mercury can make a child sick due to their smaller body size and because the developing organs are very sensitive.

Applying Mercury to the Skin

Metallic mercury that is rubbed on the skin or used in spiritual baths may evaporate and be inhaled. Smaller amounts may also enter the bloodstream directly through abraded skin and accumulate in the kidneys and the central nervous system.

④ HEALTH EFFECTS

Metallic mercury may cause permanent damage to the brain and kidneys, and may even cause death.

The type of damage to the body caused by this form of mercury is determined by how much and for how long the person is exposed to it. Vapors may be fatal if inhaled in large amounts for even a brief period of time.

Metallic mercury can persist in the body for months; mostly in the kidneys and brain. The most affected part of the body is the nervous system.

The half-life of metallic mercury in humans is approximately 30-40 days in blood and about 60 days in urine. Mercury vapor is lipid-soluble and readily crosses the blood-brain barrier and the placenta. Mercury can be detected in the brain for many years after an exposure.

Depending on the level of exposure, the appearance of signs and symptoms may vary. Health effects can occur within hours (acute) or over weeks, months or even years (chronic). Acute poisoning symptoms would be expected to occur only after exposure to very high concentrations.

Signs and Symptoms of Short-Term (Acute) Exposure:

- ◆ cough
- ◆ difficulty breathing
- ◆ chest pain
- ◆ nausea, vomiting
- ◆ diarrhea
- ◆ fever
- ◆ metallic taste in the mouth
- ◆ renal failure (shock and acute renal dysfunction)

Signs and Symptoms of Long-Term (Chronic) Exposure:

- ◆ stomatitis, gingivitis
- ◆ tremors
- ◆ erethism (strange irritability and marked shyness)
- ◆ memory loss
- ◆ headache
- ◆ fatigue, insomnia
- ◆ depression
- ◆ loss of appetite and weight loss
- ◆ behavioral and cognitive difficulties
- ◆ decreased lung vital capacity
- ◆ renal failure
- ◆ burning eyes and conjunctivitis
- ◆ rashes and peeling skin on palms of hands and soles of feet

The use of mercury in ethnomedical or religious practices typically involves small quantities administered over time. Thus, affected individuals would likely exhibit chronic symptoms.

Symptoms associated with metallic mercury exposure may be general in nature (fatigue, nausea, headaches), and often can be mistaken for symptoms of other conditions or illnesses. For this reason, mercury poisoning may be difficult to diagnose.

Mercury and Children

Metallic mercury has the greatest effect on the fetus and small children, and their developing central nervous systems.

Metallic mercury will reach the fetus of a pregnant woman.

It is important to protect pregnant women and small children from metallic mercury. It will enter the fetal bloodstream through the placenta and may produce permanent damage to the child's developing organs, especially the brain, kidneys, lungs and liver. Nursing mothers who inhale the vapors can also affect infants through breast milk.

Toddlers who crawl on floors contaminated with mercury can inhale or ingest it. The amount and frequency of mercury exposure determines the impact on a child's development. However, the younger the child, the greater the risk of long-term neurological and developmental effects.

Children are more susceptible to mercury toxicity because their organs exhibit higher absorption and retention rates of mercury, and their nervous systems are highly sensitive to the metal.

Some children exposed to metallic mercury can develop a condition called acrodynia or “pink disease.”

Signs and Symptoms of Acrodynia in Children:

- ◆ severe leg cramps
- ◆ irritability
- ◆ numbness, prickling or tingling
- ◆ painful pink fingers
- ◆ peeling hands, feet and nose
- ◆ rash
- ◆ heavy sweating
- ◆ sensitivity to light

⑥ TESTING FOR EXPOSURE AND ABSORPTION

Since users of metallic mercury may not be aware of its harmful effects, they may not mention it to their health-care providers. *It is important to ask patients if they use non-conventional or folk / traditional treatments for ailments and if any of those remedies contain mercury (azogue or vidajan).*

Environmental Testing

Metallic mercury vapors are invisible and odorless. A mercury vapor analyzer, a small machine that measures the level of mercury in the air, can be used to detect mercury within indoor environments. This measurement takes only a few minutes and the results are immediate.

Medical Testing

Several laboratory tests measure the levels of all forms of mercury in the body. Blood or urine samples can be tested for metallic mercury levels. Hair samples can be tested for long-term exposure to methylmercury (the form of mercury found in some fish), if careful testing methods are used. **But a urine test is the recommended way to measure metallic mercury levels in the body.**

The New York State Heavy Metals Registry has established reportable levels for elevated mercury. The reportable levels are concentrations at or above 5 ng/ml in blood, and at or above 20 ng/ml in urine. The mercury level in blood reflects exposure to all forms of mercury, and may therefore be influenced by dietary intake (i.e. fish).

Ideally, in order to determine elevated mercury levels, urine samples should be collected over 24 hours, but spot urine samples can be used instead, if corrected for creatinine levels. If patients report using metallic mercury, or a spot urine sample has elevated results, then a 24-hour urine collection, corrected for creatinine, should be analyzed.

For blood or urine sample analysis call the **New York State Clinical Laboratory Evaluation Program at (518) 485-5378** to find the nearest laboratory certified to conduct mercury analyses.

Treatment

Determining and eliminating exposure is the most important step in the treatment process.

There are several ways to enhance elimination of mercury from the body. Duration of use, symptoms of exposure, and mercury levels determine when and how to treat a patient exposed to mercury.

Chelators, specific agents that bind to mercury to form a nonpoisonous compound that can be excreted from the body, can reduce the body burden of mercury. Chelation should be reserved for individuals who have evidence of very high mercury absorption and significant symptoms. The appropriate chelator to use depends on the form of mercury to which a person has been exposed and the health status of the individual.

Some types of chelators are contraindicated for elemental and organic mercury compounds because of the possibility of increased neurotoxicity, so expert consultation should be sought prior to treatment.

To receive more information about testing or treatment procedures, call the **Mount Sinai Occupational Health Clinic at (212) 987-6043** or **Bellevue Occupational Health Clinic at (212) 562-4572**. Both clinics are part of the New York State Network of Occupational Health Clinics and have experience in evaluating mercury exposure.

⑥ REMOVAL AND DISPOSAL OF METALLIC MERCURY

Common household appliances should not be used to collect spilled metallic mercury. Brooms and mops will only spread the contamination. Vacuum cleaners will disperse the mercury into droplets, and the heat they generate can increase vaporization. Mercury should never be discarded into sinks, bathtubs or toilets, as it may become trapped, evaporate and re-enter the home.

When cleaning up a mercury spill, care needs to be taken to avoid contaminating clothing, shoes, and

jewelry. Metallic mercury readily binds to gold and can permanently damage jewelry.

Small amounts of metallic mercury (like the amount found in fever thermometers) can be cleaned up from hard surfaces such as tile, wood, or linoleum floors. But, if it has been spilled or placed on carpets, upholstery or porous surfaces they **should be discarded** or specially cleaned with mercury spill kits and detergents.

Mercury spill kits are sold by safety equipment distributors, industrial safety supply outlets and laboratory safety services. Check under *environmental and ecological products and services* or *laboratory safety services* in phone books.

If patients need information on how to clean up small mercury spills they can call:

NYC DEPARTMENT OF HEALTH
Bureau of Environmental and Occupational Disease Prevention
(212) 788-4290 (Business Hours)

Poison Control Center
(212) 764-7667 (24 hours a day)

If a large amount of mercury has been spilled in a home or business, people should call:

NYC DEPARTMENT OF HEALTH
Poison Control Center
(212) 764-7667 (24 hours a day)

NYC DEPARTMENT OF ENVIRONMENTAL PROTECTION
(718) DEP-HELP (24 hours a day)

If a person has a large amount of mercury in their home or business and wants to dispose of it, the NYC Department of Environmental Protection can recycle the mercury.

For more information about recycling mercury, call the NYC Department of Environmental Protection during business hours at (718) 595-4784.

⑦ LEGAL ISSUES

It is not illegal to use or sell mercury. However, Federal and New York City law requires that mercury containers be properly labeled alerting people to the hazards associated with mercury.

⑧ ADDRESSING PATIENT CONCERNS

In order to improve the well-being of your patients and their families, they should be aware of the potential dangers of mercury use. Children are at particular risk for harmful effects. As a physician, you can respect your patients' religious beliefs and still provide effective health care. Patients should be asked about their use of traditional/folk treatments and educated about the dangers of metallic mercury (*azogue /vidajan*). They should be aware of how to find out about alternatives that will allow them to continue practicing their religious or cultural beliefs, using safer substances.

Information about these alternatives can be found in the books sold in *botánicas*. Patients can also be encouraged to ask their *espiritista*, *santero*, or *doktè fey* to suggest other things that may be used in place of *azogue* or *vidajan*.

A patient education brochure is available from the New York City Department of Health. The brochure discusses the health effects associated with using *azogue / vidajan* (metallic mercury) and includes steps for cleaning up small amounts of *azogue / vidajan* in homes. For copies, call (212) 788-4290.

⑨ ADDITIONAL RESOURCES

NEW YORK CITY DEPARTMENT OF HEALTH Bureau of Environmental and Occupational Disease Prevention

125 Worth St., CN-34C
New York, NY 10013
(212) 788-4290 (Business Hours)

{For information on indoor air testing, medical and environmental levels of concern, potential assessments, patient brochures and methods for clean up of small amounts of mercury.}

NEW YORK CITY DEPARTMENT OF HEALTH New York City Poison Control Center

455 First Ave. CN-81
New York, NY 10016
(212) 764-7667 (24 hours)

{For help in acute poisoning situations and for clinical and treatment information}

NEW YORK STATE CLINICAL LABORATORY EVALUATION PROGRAM

(518) 485-5378

NEW YORK STATE NETWORK OF OCCUPATIONAL HEALTH CLINICS

New York City:

Bellevue Occupational Health Clinic

First Ave. at 27th St. Rm CD349
New York, NY 10016
(212) 562-4572

Mt. Sinai- Irving J. Selikoff Center for Occupational and Environmental Medicine

One Gustave L. Levy Place, Box 1058
New York, NY 10029
(212) 987-6043

NEW YORK STATE DEPARTMENT OF HEALTH

Bureau of Toxic Substances Assessment

1-800-458-1158 (toll free within NY State)

{Information on indoor air testing and the Environmental
Laboratory Approval Program}

**NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL
PROTECTION**

(718) DEP-HELP(24 hours a day. To report a large mercury spill.)

(718) 595-4784 (Business hours. For information on mercury
recycling).

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This brochure was developed and edited by Natasha Dwamena, Nancy Jeffery and Lori Stevenson of the New York City Department of Health's Bureau of Environmental and Occupational Disease Prevention.

**THE CITY OF NEW YORK
DEPARTMENT OF HEALTH**



Michael R. Bloomberg
Mayor

Thomas R. Frieden, MD, MPH
Commissioner

nyc.gov/health

Mercury Exposure in an Urban Pediatric Population

Philip O. Ozuah, MD, MEd; Michael S. Lesser, MD; James S. Woods, PhD; Hyunok Choi, MPH; Morri Markowitz, MD

Objective.—To determine the prevalence of elevated urinary mercury (Hg), as a marker of exposure, in a population of children drawn from an inner-city community with documented access to elemental mercury.

Methods.—A prospective consecutive patient series was conducted from November 1998 to January 1999 at an inner-city clinic in New York. Anonymous urine specimens from subjects (aged 1–18 years) were collected in mercury-free containers, split, acidified with 1:100 hydrochloric acid, and frozen. Cold-vapor atomic absorption spectrofluorometric assays were conducted simultaneously at laboratories at the University of Washington and the New York City Department of Health.

Results.—We enrolled 100 children (mean age 9.4 years; 62% male; 55% Hispanic; and 43% African American). Assay results from both laboratories were strongly correlated ($r = 0.8$, $P < .0001$). Mean urinary Hg was 1.08 ± 1.82 $\mu\text{g/L}$. The 95th percentile for urinary Hg was 2.8 $\mu\text{g/L}$ (range 0.2 to 11.7 $\mu\text{g/L}$). Five subjects had Hg levels above 5 $\mu\text{g/L}$.

Conclusion.—We found that 5% of subjects had unsuspected elevated urinary Hg levels. This finding, in a group of inner-city minority children, strongly supports the need for further investigation of the sources of mercury exposure in this population.

KEY WORDS: mercury; toxin exposure; urban health

Ambulatory Pediatrics 2003;3:24–26

Childhood exposure to mercury is a growing concern among health care providers and public health officials. Some published reports suggest that a substantial proportion of inner-city minority populations may be engaged in ritualistic uses of elemental mercury.^{1–6} These practices include sprinkling and burning elemental mercury in the home. The volatilization of elemental mercury may present a serious danger to home occupants, particularly children, because absorption of mercury vapor through the lung is nearly complete. Mercury, a potent neurotoxicant, has disproportionate effects on the developing organisms' central nervous system, and for the same dose of elemental mercury exposure, children are affected much more severely than adults.^{7–9}

In a previous report, we found that elemental mercury was readily available at folk pharmacies in a community located in an inner-city section of New York.¹ However, the full extent of elemental mercury exposure in children from this community has not been investigated. Thus, the

aim of this study was to determine the prevalence of elevated urinary mercury (Hg), as a marker of exposure, in a population of children drawn from an inner-city community with documented easy access to elemental mercury.

METHODS

Subjects and Setting

We conducted a prospective consecutive patient series from November 1998 to January 1999 at an ambulatory clinic in the South Bronx of New York City. The study site was located in the same community where we had earlier demonstrated widespread sales of elemental mercury.¹ Nearly all the children treated at this site reside in the same community. Of all children treated at this site, 69% are Hispanic, 30% are African American, and 99% are Medicaid eligible, below the federal poverty level, or working poor.

Inclusion criteria were as follows: 1) clinic visits for routine health maintenance or follow up, 2) routine urinalysis ordered by the physician, 3) no suspicion of urinary tract infection, and 4) age between 1 and 18 years. All children meeting the inclusion criteria were enrolled. All specimens were collected anonymously.

This study was approved by the Institutional Review Board at Montefiore Medical Center, Bronx, New York. Informed consent was waived because of the anonymous use of urine specimens originally collected for non-research purposes.

Laboratory Methods

Urine from each subject was placed in a polyethylene screw-cap container, acidified with 1:100 hydrochloric

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This paper was presented in part at the Annual Meetings of the Pediatric Academic Societies, Boston, Mass, May 2000.

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acid, split into pairs, and immediately refrigerated at 4° or lower. Samples from each pair were packed in a Coleman cooler with frozen cold packs and shipped by overnight express delivery service to Dr Woods' laboratory at the University of Washington in Seattle and to the New York City Department of Health Bureau of Laboratories for analyses.

Analysis of mercury in urine samples was performed using a state-of-the-art PSA Merlin Mercury Analysis System. This system employs continuous-flow, cold-vapor spectrofluorometry for mercury detection, has rapid and random-access automatic sampling capabilities (40 samples in less than 1 hour), and affords the highest possible resolution of Hg concentrations in biological media (20 ppt [ng/L] practical detection limit). Data were stored and analyzed using a computerized Touchstone software program. Each urine sample was analyzed in duplicate, and the mean of the 2 analyses was computed as the Hg concentration of that sample. A complete series of quality-control test samples derived from standard reference materials inorganic Hg solutions, including both water and spiked urine samples containing total Hg concentrations in the range of 0 to 100 µg/L, was run with each set of analyses.

To determine the prevalence of elevated urinary Hg, we considered urinary Hg levels above 5 µg/L to be elevated. Although there are no firmly established background levels for urinary Hg in children, published data indicate that the vast majority of unexposed children should have urinary Hg levels below 5 µg/L.⁹⁻¹¹

Data Analysis

The degree of correlation between urinary Hg measurements from both laboratories was examined by Pearson Correlation. Descriptive statistics were used to determine the distribution of mercury measurements.

RESULTS

A total of 100 children participated. There were no refusals. The mean age was 9.4 years. Sixty-two percent of subjects were boys, 55% were Hispanic, and 43% were African American.

Urinary Hg measurements from both laboratories were strongly correlated ($r = 0.8$, $P < .0001$). For all participants, the mean value of urinary Hg measurements was 1.08 µg/L (standard deviation ± 1.82). The 5th, 10th, 25th, 50th, 75th, and 95th percentiles for urinary Hg levels were 0.25, 0.25, 0.38, 0.64, 1.12, and 4.7 µg/L, respectively. The range was 0.2 to 11.7 µg/L.

Five subjects had urinary Hg levels greater than 5 µg/L, and 3 subjects had levels above 10 µg/L.

DISCUSSION

We found that 5% of children in this study had unsuspected elevated urinary Hg levels. These findings, in a group of inner-city minority children, have some ramifications. Published reports¹² indicate that dental personnel with urinary Hg measurements below 4 µg/L have subtle preclinical deficits in cognition, motor function,

and mood. A substantial number of children in our study had urinary Hg levels above 4 µg/L. This is potentially significant because neurodevelopmental deficits have been shown to be more prevalent among inner-city minority children.¹³ Thus, if present in the local environment, elemental mercury may be a contributing factor to the deficits observed in inner-city, low-income minority children.

We note several limitations of our study. As a result of the anonymous approach that was employed, we did not evaluate the children for recent dental work, number of dental amalgam surfaces, or dietary intake of fish. All of these factors have been associated with increased mercury burden.^{14,15} Therefore, we were unable to directly link the measured urinary Hg levels with ritualistic practices. In addition, we were unable to link the urinary Hg measurements to individual demographic data. However, regardless of the source of exposure, elevated urinary Hg is deserving of concern, especially in children. Also, we were unable to assess any relationship between urinary Hg levels and neurobehavioral function in these children, although other studies have documented preclinical toxicity in adults with low levels of exposure.¹²

The findings of this pilot study indicate that mercury exposure is ongoing in this population of children. Comparable populations are extant in cities throughout the United States. Prior work identified ritualistic use of elemental mercury as a possible source of environmental mercury exposure in this community. However, the full scope of sources and ramifications of mercury exposure among these children require more extensive study.

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Hazardous rituals: mercury pollution in the Bronx

By Ozzie Ramos, *The Bronx Journal*, 10 June 2005. English Language.

For years, elemental mercury or *azogue*, has been used in the Afro-Caribbean communities for ritualistic purposes. Families practicing *Vodun*, *Santeria*, *Espiritismo*, and other underground religions often use the substance to cleanse their homes of spirits, to put spells on loved ones, even to improve the skin or cure intestinal disorders. "As a girl, I used to watch my aunt cleanse her home with mercury," said Evelyn Cordero of the Bronx, as she left La Division Botanica on Fordham Road. "I remember wondering what made the water glitter as she mopped."

In March, the Rockland County Department of Health added an article to its health code that prohibited keeping mercury in an uncovered container in homes. It also required that all mercury sold in stores must be correctly labeled in English, French and Spanish, and must contain warnings about its danger. In addition, vendors are required to inform buyers of the dire consequences of mercury spills and exposure.

"This was specifically done because of the knowledge that people in the Afro-Caribbean neighborhoods of Rockland were using mercury for ritualistic purposes," said Dr. Arnold Wendroff, the environmentalist and director of the Mercury Poisoning Project, who has been monitoring mercury use in these communities for more than ten years.

Is this a wake-up call for the Bronx?

Given the Bronx's much larger Haitian and Latino community, why has New York City's Department of Health not enacted similar laws banning the use of uncontained elemental mercury? "There is published hard data on mercury sales in the Bronx, and on the influx of mercury into the sewage treatment plants like Ward's Island," said Wendroff. "But no one wants to rock the boat because they know there's a major mercury problem in the Bronx."

Even Rockland County is careful about rocking the boat. Which is why, said Wendroff, the Rockland County Health Code sets its own level for the evacuation of buildings, using a measurement of mercury levels that is 100 times higher than those currently used in the rest of the country. (the national standard for evacuation in mercury spills is 1 microgram per cubic meter of air. For Rockland, it is 100 micrograms.). "And the reason why it's so high," he adds, "is apparently because the Rockland County Department of Health believes there is a problem, but they have no place to put people who would be displaced from their homes during an evacuation."

Carmen Santiago sells religious items at the Guadeloupe Botanica on the Grand Concourse and 183rd Street. "Mercury wards off evil spirits in the home, and has been used for that purpose for quite a while," she said. "I know mercury is bad for you and that the cops will close you down if you

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sell it. I also know that you can still buy in some botanicas if you know someone. But I don't see it."

Neither does the owner of La Division Botanica, a man who calls himself "Professor" Eliseo, but refuses to reveal his given name. Eliseo, 52, who has owned his botanica for nine years and also teaches Espiritismo for \$150 a session, said, "I have been men pour mercury from the jar into gelatin capsules to sell it for a couple of dollars. And I used mercury a couple of times myself by placing it in candles." Eliseo said he stopped after hearing about someone who drank mercury to cure his intestinal problems, but damaged his kidneys in the process. "I can tell you that mercury is being sold and used today. But I do not either sell it or use it," he adds. Instead, he employs herbal preparations in the rituals he practices.

Eliseo points out that since 9/11, paranoia has spread throughout the botanica circuit. "I've heard rumors that if you sell mercury, you can be arrested because the government would think you might be making bombs," he said.

There is no truth to the notion that mercury is an ingredient for bombs. It is also not illegal, as long as it is properly contained and labeled. What is true, however, is that mercury is a menace. Sprinkled on floorboards, it evaporates and seeps into the floors and walls for up to 15 years.

Inhabitants of an apartment inhale the invisible and undetectable vapors, which can damage the brain, heart, lungs, and liver. Children and fetuses are especially vulnerable to mercury's effects, which can include insomnia, bronchitis, emotional instability, neurological problems, gingivitis and developmental problems.

"What users don't know is how toxic mercury is long after they've used it," said Wendroff, "and how compromised developmentally they may become if they have been contaminated." Unlike lead or asbestos, he points out, mercury breaks up. "It's a liquid and a gas at the same time. The little droplets on the floor are continuously evaporating. And the vapor is what's toxic. It is inhaled and absorbed into the blood. The exposure is continuous and lasts for years." Which means that families who move into apartments where practitioners once sprinkled mercury are also at risk, although they may not suspect it.

To measure the extent of mercury use in the Bronx, doctors at Montefiore Medical Center conducted a study in 1995 in which an Espiritismo practitioner went to Bronx botanicas to see if she could buy mercury at each. She was able to buy unlabeled mercury at 38 of the 41 botanicas she visited. Thirty-five shops reported sales averaging 930 pounds a year. In addition, more than 29 percent of botanica workers and customers indicated that the primary way they used mercury was to sprinkle it on floors.

Since 1995, said Wendroff, "Somewhere between 8,000 and 50,000 homes per year are being contaminated with enough mercury to warrant evacuation."

Local environmentalists like Marian Feinberg, the environmental health coordinator of the organization "For a Better Bronx," believe that these statistics are alarmist and that putting the blame solely on the Hispanic community is racist. "If mercury is so dangerous, why are dentists still putting it in our mouths?" she said. "most of the mercury in the environment that we're exposed to comes from power plants. The tuna fish that you eat today is more dangerous. It's full of mercury."

Wendroff, who has a Ph.D in medical sociology with a specialty in the traditional medicine and witchcraft of the southeast African country of Malawi, where he served in the Peace Corps, first became aware of the mercury problem in 1991 while teaching science at a Brooklyn junior high school. Pointing to the symbol for mercury, he asked if anyone knew what it was used for, thinking that kids would reply, "Thermometers." However, one boy volunteered that his mother sprinkled mercury on the floor to ward off what is known in Santeria as brujo, or evil spirits. "It suddenly rang a bell," said Wendroff, who also noticed that the child was exhibiting signs of mercury exposure such as anorexia, irritability and forgetfulness.

Wendroff claims that not only are individual homes tainted by mercury use, so is the city's water supply. It becomes compromised when excess mercury is either flushed down toilets or poured down drains after Santeria rituals are completed.

However, mercury in the community has become a taboo subject. Few want to talk about it, and even fewer want to own up to the fact that it is a problem. The New York City Department of Environmental Protection tested New York City's waste water in late 2003 and early 2004 and discovered that there was an enormous excess of levels of mercury in the Ward's Island plant, which serves Washington Heights and the South Bronx.

Most politicians, like Congresswoman Nydia Velasquez, Senator Bill Bradley, former Mayor David Dinkins, and former Bronx Borough President, Fernando Ferrer, have paid lip service to the problem, but little more. Wendroff claims to have written to almost every local politician and said that they have either ignored him or voiced their concern with no follow-up. When The Bronx Journal contacted Bronx Borough President Alfonso Carrión and Ferrer for this article, they both refused to comment.

Mercury is a political hot potato, said Wendroff, in part because politicians fear alienating the Hispanic community by placing the blame on ritualistic mercury use, and in part because any real solution is expensive. "Cleaning up mercury spills can cost up to \$50,000 per apartment," he explains. "It can be cleaned up. But first you have to find it, which is also expensive. And embarrassing. Because all these political people know. And so does the media. They're treating it as a 'potential health threat' and not doing the research themselves." In the end, he believes, the government, because of its past negligence, will be directly responsible for the cleanup.

What both Wendroff and Feinberg agree on is that public health education is crucial. "I don't think it's about politicians," said Feinberg. "It's about health education. The most affecting change will come when people will start to be more educated in general about the problem."

Still, Wendroff remains skeptical. He points out that in 2000 the New York City Department of Health created two pamphlets, one for laypersons in English, Spanish, and Creole, and another for health care workers. "But they never adequately distributed them to the public," he said. "They did a cover-your-ass operation. And that was it. The city is at a fabulous, fabulous legal liability. After all, our officials failed to seriously assess the problem. And they never communicated their concern to the people."

For now, the Bronx—and the New York City Department of Health—needs to take inspiration from Rockland. As Dr. Joan Facelle, Rockland's health commissioner, said bluntly, "We don't know the extent of the problem."

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Hudson County, New Jersey

UNION CITY REPORTER.com

12/17/2006

Mercury scare

Santeria, and other religions in UC, WNY [Union City, West New York] can employ toxic rituals

Jessica Rosero
Reporter staff writer

Dr. Arnold Wendroff of Brooklyn has spent the last 15 years trying to get health officials to do something about toxic practices in certain local Hispanic religions, including those practiced in West New York and Union City - like Santeria and Palo Mayombe.

The two religions, which were brought to local communities from Latin America, employ the toxic metal mercury in some of their rituals, which can lead to contamination of the surroundings.

In the late 1990s, Wendroff testified at the Department of Environmental Protection about his concerns, and they formed the Mercury Task Force out of the Department of Health, and performed a study of the immediate area entitled "Cultural Uses of Mercury in New Jersey." It was completed by December of 2002.

The study interviewed 22 practitioners of Santeria and related practices, of which 17 used mercury in some form, and conducted surveys of air mercury levels in buildings in Hudson County.

According to the report, "Measurements of mercury concentration in air were obtained in the hallways of 34, and in the entrance vestibules of an additional 33, multi-family apartment buildings in Union City and West New York, N.J., using a highly sensitive Lumex portable mercury analyzer. Comparison buildings in Montclair, N.J. were also analyzed."

The average amount found was about two micro grams coming from under the apartment doorways. "Evacuation is official after the discovery of 10 grams," said Wendroff. "Certainly plenty of grounds for knocking on the door."

The report stated, "In two of the buildings, the maximum building hallway concentration exceeded the U.S. EPA's Reference Concentration guideline of 330 ng/m3, although levels were significantly decreased in subsequent visits."

Where's the follow-up?

Wendoff worries that people who don't understand the dangers of mercury might use it in religious rituals and harm children and neighbors. And he is concerned that in Union City and West New York, the silvery substance may have affected hallways and even the water near the homes of heavy users.

But despite Wendoff's pleas to local and state officials, there has been no action taken recently.

Santeria and Palo Mayombe (usually referred to simply as "Palo") trace their roots to West African religions, which were brought over to the "New World" - more specifically the Caribbean Islands - by slaves. After that, they were brought northward from Cuba to the United States.

While some rituals were lost due to cultural mixing with Judeo-Christian neighbors, among some the practices that have been preserved was the tradition of possession trance, which was meant for communicating with ancestors and deities.

That practice had a huge following in the Caribbean isle of Cuba, and evolved into today's "Santeria," or "The Way of the Saints." Animal sacrifice and dancing are also common to Santeria.

"Elemental mercury is put to magico-religious uses, most problematically the sprinkling of mercury on floors of homes in Caribbean and Latino communities," wrote Wendroff, a retired lecturer at Brooklyn College, in his 2005 environmental review for the National Association of Environmental Professionals. "Indoor mercury spills are persistent and release toxic levels of mercury vapor over long periods of time. Surveys in these communities have demonstrated widespread and large-scale mercury sales for ritualistic use, elevated mercury vapor levels in public hallways, increased amounts of mercury in wastewater, and elevated urine mercury levels in Latino children."

Recently, Wendroff tried to bring the matter to the attention of Gov. Jon Corzine. He has been corresponding with Keri Logosso, health policy advisor to Corzine.

Wendroff wrote to Logosso in September urging the state Department of Environmental Protection to expand its indoor air mercury vapor measurement program, as well as begin a wastewater mercury study.

Logosso replied in an e-mail dated Sept. 25, 2006, "As promised, I am sharing the information you forwarded to me with my colleague, Debbie Mans, who focuses on environmental policy for the governor. She and I will discuss next steps and will reach out to you should we need clarification or additional information."

Wendroff has not proven that most local followers of the religions are still using mercury. However, one local "high priest" of Palo confirmed to the Reporter that the dangerous element is still in use locally today.

A high preist of Palo speaks out

"Tata" is a Hudson County resident who did not want his hometown used.

Tata said recently that mercury, known in the culture as "asoge," is not the only dangerous substance utilized in blessings and rituals among the practices.

"For example, sufre (acid) can be used to clean the home," he said, "and if I wanted to do brujeria (witchcraft) on you, I would use the asoge to move it along."

Tata, who has practiced the religion for 20 years, explained, "[mercury] could be used for a whole manner of things; even to destroy a marriage. These things come from a tradition that has been done for years."

Santeria and Palo also employ harmless rituals, like those using candles or chicken bones.

But some of their practices involve poisonous substances.

"Santeros put the drops of asoge (mercury) on the head of the saint [statue] they wish to work for them," said Tata. "We use asoge as well. We drink it because it's a form of protection for us. Its like a cleansing in the stomach."

Tata said that practitioners can buy a capsule of asoge and break it open to use it, and mix it with other ingredients depending on the ritual. Then, they ingest it.

Many followers will put asoge in the base of their saint statues, along with other elements depending on what they're asking for, "so that it will move along and start to go," Tata said.

The fact that asoge is meant to speed things up takes into account the nature of mercury itself. When mercury spills, the silver liquid droplets split apart and slide quickly in various directions.

How it all began

The practices of Santeria caught Wendroff's eye when he was introduced to the practice by some of his students of Hispanic/Caribbean descent more than 15 years ago.

Wendroff became increasingly concerned about overexposure in his native Brooklyn community, as well as New Jersey's North Hudson area, which is home to one the largest Hispanic communities in the nation. Over the last 40 years, Latinos from Central to South America have made their permanent home here. During the Cuban exodus of the 1960s, Union City became the second largest Cuban community in the nation after Miami, Fla.

According to the 2000 Census, of 45,768 residents of West New York, 36,038 of them are Hispanics of all origins. In Union City's population of 67,088, there are 55,227 Hispanics.

Union City and West New York together have an average Cuban population of 8,991 and Puerto Rican population of 2,791.

In the late 1990s, Wendroff testified at the Department of Environmental Protection, which led to the aforementioned 2002 report. One of the individuals quoted in the report was Gary Garetano, assistant director of the Hudson Regional Health Commission.

Wendroff was concerned about the lack of follow-up.

"It has been five years since that study and they haven't followed up on it," said Wendroff. "What are we going to do? No one wants to open up Pandora's box."

Wendroff said that it would be expensive for the government to clean up all the mercury, if discovered.

"They would have to inspect the housing for this," said Wendroff. "It would be enormously expensive. To clean it up is astronomical and time consuming."

He said that the curious thing about the study was that they never found a concentrated area of spill, but it seemed to be evenly distributed among the homes.

"There was nothing on the floor or the hallways, but it seemed uniformly distributed coming from underneath the doors," said Wendroff.

Dangers of mercury

Since there have been no other major official studies or investigations into the matter, no clear connection has been made between the mercury used in religion and the elevated levels of contamination that have been found among households and families.

Unfortunately, many of those who are potentially contaminated in these communities may not even be aware of possible daily exposure.

The problem lies within the mercury itself, which can take 10 to 15 years to fully dissolve.

Mercury exposure can damage a person's nervous system. The fumes easily enter and poison the body. Just short-term or limited contact with mercury can cause acute symptoms such as bleeding gums, vomiting, and stomach pain. In extreme cases, mercury poisoning can cause irreversible brain, liver, and kidney damage due to the difficulty for the body to eliminate the substance.

In centuries past, mercury was used by hat-makers in turning fur into felt, thus affecting the nervous systems of hatters. Some were thought to be "mad," thus the character of the "Mad Hatter" in the book *Alice in Wonderland*.

Hey, where can I buy some mercury?

Tata said that it's a bare minimum that is always used, and it is sold in capsule form.

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He said that he used to find it in botanica shops in Union City, where he said that he had to specifically request it. (Botanicas are shops that sell herbs, charms, and religious or spiritual items like statuettes.)

However, Tata said that it's harder to find in North Hudson now - but he can still get it in New York City.

In fact, the Reporter visited three different botanicas in the North Hudson to see if they carried the mercury capsules.

All three denied having it, but recommended heading to Manhattan and Brooklyn.

"None of the botanicas sell it, and I know, because I supply most of the botanicas in this area," said one store owner in West New York. "It's illegal to sell that. But you could possibly find it in Manhattan on Broadway, and the ones that do carry it only sell it to you if they know you."

According to Wendroff, a study done by the Latin American Foundation for Environmental Protection, a group that mostly consists of Dominican college and graduate students, revealed that they visited 180 botanicas in the New York City and New Jersey metro area. Approximately 169 to 170 of them were carrying mercury after they said they weren't.

"These days, those capsules can cost about \$5, which is more expensive now," Tata said. "A few years back, a capsule would cost anywhere from \$0.50 to \$1. As far as I know, the use of it is very rare these days."

'I have swallowed it three times'

Tata said he does not see a big problem with mercury.

"I have swallowed it three times and nothing has happened to me," said Tata. "You use a small amount."

The government has been more concerned about people ingesting mercury that is found in fish. In 2004, the United States Food and Drug Administration (FDA) and the Environmental Protection Agency (EPA) issued consumption guidelines stating that pregnant women, children, nursing mothers, and women who may become pregnant should not eat certain fish such as shark, sword fish, king mackerel, or tilefish.

The agencies also recommended that this group reduce its consumption of tuna, especially albacore tuna.

Trying to get someone to listen

Wendroff was part of a recent 2004 preliminary study conducted by the United States Environmental Protection Agency (EPA) entitled "Ritualistic Use of Mercury Simulation: A Preliminary Investigation of Metallic Mercury Vapor Fate and Transport in a Tractor," which included simulations of ritualistic use in the home.

The conclusion from the EPA was, "This study shows intentional ritual sprinkling of metallic mercury or accidental spillage of mercury may initially produce indoor air mercury concentrations above the ATSDR suggested residential occupancy level, and in some cases above the action level. When the source is undisturbed, the concentration decreases over time and generally falls below the residential occupancy level. [But] periodic spillage or ritual application of a small amount of mercury for a sustained period of time ... may lead to chronic mercury vapor exposure with possible detrimental health effects."

Despite such information and warnings, followers of Santeria and Palo continue the use of the chemical substance because it is part of tradition, and don't believe it has ever made them ill.

However, non-followers can also be affected if they move into the space that was once occupied by a Santero or a Palero (a practitioner of either religion).

"Here we have people that are habitually using this stuff, and contaminating the homes," said Wendroff. "In general in minority ethnic neighborhoods, there is an excess of kids in special education programs [although there is no scientific link]."

At the moment, Wendroff just wants investigators to do studies.

He said that there have been a few positive measures taken. At one point, the Hispanic Health Council in Hartford, Conn., started passing out pamphlets about the use of ritualistic mercury, he said.

Wendroff had also continuously corresponded with a legislative assistant to Sen. Robert Menendez, a Union City native, while Menendez was still in the House of Representatives. And he has written to state environmental officials, always including copies of the 2002 and 2005 reports.

In return, Wendroff received a correspondence from Jeanne M. Herb, director of the New Jersey Department of Environmental Protection, dated June 22, 2006.

Herb wrote, "We have been aware there are several related cultural practices that include the use of elemental mercury that occur in particular areas of New Jersey, but the research we have shows no direct evidence of mercury contamination in homes in these areas."

Herb pointed out that the results of the NJDEP study conducted in 2002 have also been posted on the NJDEP Division of Science, Research, and Technology (DSRT) website since May of 2003.

"This research suggested residential buildings in the suspect areas tended to have elevated levels of mercury vapor compared to outdoor air," she conceded. "However, these findings could not distinguish between mercury vapor resulting from unintentional spills, from thermometers for example, which would likely be found throughout the state, and elevated levels resulting from intentional cultural uses of mercury."

Yet, Herb agreed that some additional research is needed, as well as an intervention strategy.

She wrote: "The NJDEP did, indeed, undertake a follow-up study to address the need for additional research. This study commenced in September of 2004. The final report of that study was only recently received and approved by the NJDEP."

Herb said that when the results are made public, they will be posted on the website at <http://www.state.nj.us/dep>.

For more on Dr. Wendroff's research, visit www.mercurypoisoningproject.org.

MERCURY POISONING PROJECT

www.mercurypoisoningproject.org

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March 3, 2007

Brian Stack
Mayor,
City of Union City
3715 Palisade Avenue
Union City, NJ 07087

(201) 348-5728

Dear Mayor Stack,

In December 2002 the New Jersey Department of Environmental Protection (NJDEP) issued a report, Cultural Uses of Mercury In New Jersey (www.mercurypoisoningproject.org/pdf/njdep.pdf). A summary of that report was issued in May 2003 (www.state.nj.us/dep/dsr/research/mercury-cultural.pdf). This report, and several similar papers in learned journals as well as a doctoral dissertation have all addressed a similar environmental health concern, namely, that there appears to be widespread mercury contamination of housing in Union City, as well as in neighboring West New York.

The source of this domestic mercury contamination is believed to be mercury sold at one time or another by the many botanicas in Union City and West New York, (and possibly elsewhere, as in Manhattan, etc.), which has been put to a variety of ritualistic uses (folk-magic, Santeria, Espiritismo, etc.) by members of these two heavily Caribbean-Latino communities. This ritualistic or magico-religious mercury use is guided by the generic belief that mercury (*azogue*, *mercurio*) attracts good and repels evil. Although there are many ways in which mercury is used to effect these ends, including placing mercury in a wide variety of un-sealed containers, the single most problematic use of mercury is to sprinkle it on the floors of homes, and in automobiles.

This sprinkling of floors with mercury, typically the equivalent of breaking some dozen clinical thermometers without cleaning them up, is guaranteed to contaminate the home for well over a decade with levels of mercury vapor that are certain to be prejudicial to normal neurodevelopment. This is in many ways similar to the widespread contamination of housing with lead, which results in neurodevelopmental deficits in children reared in these contaminated environments.

The Union City Health Office has been aware of this situation for some time, as has your Office. Yet to date, there appears to have been no substantive action taken to address this latent (but very real) environmental health disaster. It seems to me that your Office has a moral as well as a legal responsibility to address this issue. You must request assistance from the NJDEP as well as from the NJ Department of Health and Senior Services, and they in turn will need to turn to the appropriate federal agencies, particularly the US Environmental Protection Agency, and the Centers for Disease Control.

More information on this issue can be found by typing < **mercury Santeria** > into Google, Yahoo etc. search engines, and by referring to my web site. Your Health Officer, Richard Censullo, is quite familiar with the issue, as is his counterpart in West New York, Vincent Rivelli. The best single source of information on the problem is Dr. Gary Garetano of the Hudson Regional Health Commission.



You need to act on this issue in your joint capacities as a Mayor and as a New Jersey Assemblyman. Your colleague John McKeon of the Assembly's environmental committee is well aware of the issue, although he has refrained from addressing it. I suggest that you confer with Mayor Vega and the relevant health authorities to devise a strategy to eliminate the ongoing exposure of pregnant women and children to toxic levels of mercury vapor in their homes, much of it from mercury sprinkled years ago by some prior occupant. As federal funding is certain to be required, I also suggest that you contact Representative Sires for his assistance. I look forward to your response.

Sincerely yours,

cc: Richard Censullo, Health Officer, Union City (201) 392-2153 fax
Silverio Vega, Mayor, West New York (201) 861-2797 fax
John McKeon, N.J Assembly (973) 275-1480 fax
Albio Sires, U.S. Congress, 13th District, N.J. (201) 617-2809 fax

* The saying "**the buck stops here**" derives from the slang expression "pass the buck" which means passing the responsibility on to someone else. The latter expression is said to have originated with the game of poker, in which a marker or counter, frequently in frontier days a knife with a buckhorn handle, was used to indicate the person whose turn it was to deal. If the player did not wish to deal he could pass the responsibility by passing the "buck," as the counter came to be called, to the next player. www.trumanlibrary.org/buckstop.htm

[NOTE: Annotated by Arnold P. Wendroff, PhD - 2018]

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Mercury Contamination

Review of a Residential Response

[Marcella R. Thompson](#)

IN BRIEF

- A residential elemental mercury contamination incident in Rhode Island resulted in the evacuation of an entire apartment complex. [How many homes in the Bronx, NY alone would likely have to be evacuated based on the data in Zayas & Ozuah, *AJPH* 1996, and Ozuah et al, *Ambulatory Pediatrics* 2003?]
- To develop recommendations for improved response, all response-related documents were examined; personnel involved in the response were interviewed; policies and procedures were reviewed; and environmental monitoring data were compiled from specific phases of the response for analysis of effect.
- A significant challenge of responding to residential elemental mercury contamination lies in communicating risk to residents affected by a HazMat spill. An ongoing, open and honest dialogue is emphasized where concerns of the public are heard and addressed, particularly when establishing and/or modifying policies and procedures for responding to residential elemental mercury contamination. [The residents of housing in Union City and West New York, NJ, found to be contaminated with elemental mercury by the NJDEP were never even informed that their apartments were emitting high levels of mercury vapor into their common hallways. (NJDEP 2003; NJDEP 2007; Garetano et al 2006 *EHP*; Garetano et al *Sci. Total. Envnt.*2008)]

A residential elemental mercury contamination incident in Rhode Island resulted in the evacuation of an entire apartment complex, temporary relocation of 140 residents and subsequent investigation of 130 additional sites in 15 cities across two states. This study was undertaken to develop evidence based recommendations for responding to future incidents, thereby increasing the efficiency and expediency of response and remediation processes; minimizing secondary contamination of evacuation sites; facilitating a more timely return of residents to their homes; and assuring residents that their homes are safe once again. [Although this paper mentions the environmental health threat posed by the magico-religious uses of elemental mercury, as witness her mention: “mercury has been incorporated into certain sociocultural behaviors and ritual practices that can occur within a residence (EPA, 2002),” it provides no guidance as to how to proceed when the relevant local, state, and federal agencies refuse to adequately assess the source of mercury spills suspected to be of magico-religious origin, as witness the aforementioned NJDEP studies of 2003 and 2007. Even more interestingly, particularly because this paper is of a case study in the small state of Rhode Island, is the omission of mention of the case of acute (acrodynia) mercury poisoning of a three year old ethnically Puerto Rican girl in Cumberland, RI, from a putative ritualistic mercury spill by the prior occupant of her HUD Section 8 apartment (Mercer et al, *Pediatric Dermatology* 2012; Brannan et al, *Pediatric Emergency Care* 2012) and the chronic mercury intoxication of her two siblings and mother.]

The first step involved a review of scientific literature (see “Hazards of Mercury” sidebar on p. 52). In addition, the author examined all response-related documents, interviewed key government and contract personnel involved in response, reviewed and evaluated national and state regulatory policies and procedures, and

extracted and compiled large amounts of environmental monitoring data collected during specific phases of the response. Residents were not interviewed due to pending litigation. There were no records of any meetings with the residents.

The Contamination Site

The incident occurred at Lawn Terrace Apartments in Pawtucket, RI. The complex has five apartment buildings with a total of 56 apartments. [How could government respond to assessing and decontaminating thousands of apartments in the Bronx, NY alone, let alone those in Caribbean and Latino communities where ritualistic mercury use has been documented, in Lawrence, MA; Chicago, IL; Los Angeles, CA; Miami, FL; San Juan, PR? According to data presented by Zayas & Ozuah (*AJPH* January 1996), in 1995, between ~25,000 and ~150,000 9 gram mean weight units of mercury were sold for ritualistic use in the Bronx, NY. 29% were recommended to be sprinkled on floors of homes. At one unit per home, between ~8,000 and ~50,000 homes would be contaminated in one year. In 2002, the New York Academy of Sciences, under contract to EPA Region 2, found that the median source of mercury entering the NY/NJ Harbor was in essence a tie between emissions from coal-fired electric power plants, and religious and cultural uses of mercury. Each estimated at a mean of ~400 kilograms per year, and each with an error bar, or estimated range of between ~200 to ~600 kilograms per year. (de Cerreno, Panero, Boehme, NYAS 2002 p. 22)] and one maintenance building ([Burns & McDonnell Engineering, 2005](#)). These units alternate between subsidized housing and open market, depending on the renter's economic status and eligibility. The complex is adjacent to an unoccupied and unsecured property owned by the region's gas company, Southern Union. On that property, the company stored mercury removed from residential gas regulators.

Summary of Events

On Oct. 22, 2004, local authorities notified the Rhode Island Department of Environmental Management (RIDEM) of an elemental mercury spill, the result of vandalism that occurred sometime within the prior 3 to 4 weeks. Initially, it was estimated that 25 lb of mercury were spilled inside the gas company's storage shed with an equal amount missing. A maintenance employee told authorities about beads of mercury in the adjacent apartment complex parking lot ([Marcelo, 2008](#)). [How much of this mercury in the form of "beads ... in the adjacent apartment parking lot," could adhere to a person's shoes, and hence be transferred to that person's apartment? In other words, what is the estimated amount (in grams) of mercury that contaminated a typical apartment that was transported on occupant's shoes from beads in the parking lot into their apartment? I estimate that at most it was a small fraction of one (1) gram. Has there been any study to measure how much elemental mercury adheres to footwear soles? The minuscule amount of mercury adherent to shoes/footwear soles, was doubtless magnified by the occupant's repeated walking through the contaminated parking lot, multiplying the amount of mercury deposited into their apartments. How would this compare with the intentional ritualistic sprinkling of some ten (10) grams of mercury on floors of apartments?]

Referral

RIDEM notified EPA Region I, since the reportable quantity for elemental mercury is 1 lb. One pound of elemental mercury is equivalent to 2 tablespoons; 25 lb equals 1 quart. EPA emergency response guidelines for residential mercury contamination were employed ([Singhvi, Mehra & McGuire, 2004](#); see "Six Rs of Emergency Response" sidebar on p. 54). RIDEM, EPA Region 1, Rhode Island Department of Health Office of Environmental Health (EHEALTH) assumed joint command for the response.

Reconnaissance

Initial environmental monitoring was conducted with the only Jerome Mercury Vapor Analyzer (MVA) available. An initial assessment and clearance screening level (ACSL) of 3,000 ng/m³ was used ([Tables 1, 2, 2](#)). These readings were taken in real-time. Three of the six buildings' common areas failed this criterion ([Table 3](#)).

Table 1
U.S. EPA Action Levels

Mercury Concentration Level measured in air ¹	Response
1 $\leq 10,000 \text{ ng/m}^3 \text{ (real-time)}$	Evacuate residents immediately
2 <math>> 1,000 \text{ ng/m}^3 \text{ to } < 10,000 \text{ ng/m}^3</math>	Schedule relocation as soon as possible
3 $\leq 1,000 \text{ ng/m}^3 \text{ (8-hr TWA)}$	No action necessary

Note. From Mercury Response Guidebook, by U.S. EPA Region 5, 2001, Wash DC.

[Table 1](#)

U.S. EPA Action Levels

Table 2
U.S. EPA Action Levels for Mercury Concentrations Measured in Soil

Land use	Mercury action levels (concentration measured in soil)
Residential	16 mg/kg
Commercial	250 mg/kg

Note. From Mercury Response Guidebook, by U.S. EPA Region 5, 2001, Wash DC.

[Table 2](#)

U.S. EPA Action Levels for Mercury Concentrations Measured in Soil

Table 3
Units Failing Initial ACSL

Building ($\leq 3,000 \text{ ng/m}^3$)	% Units Failed ACSL
1	50%
2	100%
3	92%
4	87%
5	83%
6	100%

[Table 3](#)

Units Failing Initial ACSL

Subsequent to this initial screening, a national call was issued for Lumex 915+ and Lumex RA-915 Light meters for reconnaissance, remediation and reoccupancy. **Lack of real-time equipment availability was a major obstacle to efficiency.** [What would be the scenario when large numbers of homes have to be assessed for mercury vapor levels? A natural experiment of this occurred in the NICOR mercury spill incidents in 2000, illustrated this bottleneck (EHP Hryhorczuk, et al. *Environmental Health Perspectives*, June 2006).] Contractors reported that the Lumex meters only had 3.5 hours of actual work time. Recharging took 8 hours, during which the unit had to be turned off. Additionally, 10% variability was found across units due to differences in sensitivity and drift (see “Direct Reading Instruments” sidebar on p. 57).

Hg⁰ Air Monitoring

On Oct. 28, RIDEM, EPA Region 1 and EHEALTH agreed to an ACSL of 300 ng/m³, the **inhalation reference concentration (RfC)** for elemental mercury (EPA, 1999). **An RfC is an estimate of a continuous inhalation exposure concentration to people (including sensitive subgroups) that is likely to be without risk of deleterious effects during a lifetime** (EPA, 2011). [None of the local, state and federal agencies, and academic institutions cited in this paper, have shown any *substantive* concern over the ongoing domestic mercury vapor exposures that put occupants at “risk of deleterious effects during a lifetime.”]

Over 3 days, contractors conducted a detailed environmental assessment using MVAs. [Think of how long it would take to conduct detailed environmental assessments using MVAs in the Bronx, NY, or Lawrence, MA, or Union City, NJ!] They measured every room with 10-second average samples at each sample point at a minimum of 1 to 3 in. and 3 ft above the floor. Additional samples were taken of upholstered furniture, beds, closets, sink and tub/shower drains, and vacuum cleaners. In one building, four apartments had readings above 28,000 ng/m³, requiring response personnel to wear level C PPE (air-purifying respirators with mercury vapor cartridges). Seven apartment units had levels within $\pm 20\%$ instrumentation error (240 to 300 ng/m³) (Table 4, p. 53).

Hg ⁰ (ng/m ³)	Unit				
	1	2	3	4	5
Building entry	297	6,438	89	1,570	159,1420
Bulder room	114	627	1,039	1,522	NA
Unit 1	372	2,307	1,048	793	74,2760
2,295	5,478	797	392	7,420	
3	224	504	4,972	284	3,373
4	200	1,820	276	294	125
5	143	13,090	2,039	230	342
6	302	28,836	1,649	446	675
7	1,357	2,404	420	299	1
8	314	28,999	322	487	

[Table 4](#)

Highest Mercury Vapor Readings From Initial Site Assessment by Unit & Building

Locations of Highest & Lowest Hg⁰ Readings

In 62% of the apartments, the **highest reading** was found in the apartment's **entryway**. In 65% of apartments, the **lowest reading** was in the **bedroom**. Sixty-eight percent of the highest readings were found at floor level (Table 5, p. 53). [This implies that the mercury was tracked into the apartments on the shoes/footwear of the occupants, and therefore, the amount of mercury entering any apartment in this manner must have been very small, a minute fraction of the approximately ten (10) grams believed to be ritualistically sprinkled on the floors of Caribbean and Latino apartments (Wendroff, *Nature* 1990; Zayas & Ozuah, *AJPH* 1996)] Sixty-eight percent of the highest readings were found at floor level (Table 5, p. 53).

Hg ⁰ Readings	Specific location						Sampling level		
	Entry	Kitchen	Living	Master	Bedroom	Bath	Floor	Ward	Breathing
Highest	30	2	7	0	4	5	24	9	7
Lowest	3	7	5	15	13	3	1	1	1

Note: instrument used: Luxem 913+ meter with level of detection 2 ng/m³.

[Table 5](#)

Highest & Lowest Readings of Mercury Vapor by Specific Location & Sampling Level Within Each Apartment

[Go to:](#)

Relocation

All 140 residents were sent to local hotels with the assistance of the Red Cross or stayed with relatives or friends. [How will the Red Cross deal with thousands of displaced occupants of mercury contaminated apartments in the Bronx, NY alone? The only possibility is to set standards for, and certify portable mercury vapor filters, that can be placed in apartments that have been found to be contaminated.] Residents were not told how long they would be relocated. Most assumed it would be a few days. Limited documentation was available regarding screening of individuals for mercury contamination prior to relocation. Some residents left without being screened.

Some personal belongings underwent screening. Because too few analyzers were available, the screening process was time-consuming; this angered residents so some left the premises without being screened. Those belongings that failed screening were held on site. Nothing in the available documents indicated that responders intended to decontaminate the residents, their pets or their belongings prior to relocation.

Since no perimeter security was established initially, property and building access continued sporadically for 8 days, with many residents subsequently removing unscreened items from the property. It was generally assumed that if some of a resident's belongings were found to be not contaminated, all of that resident's belongings were not contaminated. **This contributed significantly to secondary contamination of other sites.** [In the case of intentional ritualistic mercury use, where some 10 grams of mercury may be intentionally sprinkled on floors, on occasion repeatedly, it would appear as if this scenario, of secondary contamination, would be likely as well.]

Removal

RIDEM abdicated oversight responsibility to Southern Union since the gas company had accepted liability and agreed to pay all remediation costs. Southern Union then hired contractors to perform removal and replacement. These contractors met EPA registration guidelines for hazardous waste/mercury handler/transporter, minimum insurance requirements for environmental spills, workers' compensation and other liabilities, and verifiable business history.

Each contractor created and implemented a safety and health plan ([EPA, 1991](#)). While RIDEM met with contractors regularly, it made no attempt to coordinate their efforts. In addition, no third-party safety and health professional was on site to ensure that each contractor followed EPA remediation and sampling guidelines. There were inconsistencies with documentation, monitoring and remediation procedures among and within on-site contractors.

Decontamination Process

In 3 weeks, contractors documented the contents of each apartment and identified mercury-impacted items. A scribe was paired with each worker to assist with this process. Subsequently, mercury-impacted items were cleaned using a decontaminating agent ([HgX Acton Technologies, 2008](#)) and/or a special vacuum with a high-efficiency (HEPA) filter (Mini-Merc Nilfisk, 2008).

After each round of cleaning, the apartment was resampled for mercury vapors. Concurrently, remediation began in the least and most contaminated buildings. **Unfortunately, some remediated apartments were recontaminated during remediation of more heavily contaminated apartments,** thus requiring additional rounds of decontamination. [The cross contamination of apartments, in buildings where mean weights of ~10 grams of mercury has been intentionally sprinkled on floors, in some cases repeatedly, is a certainty. In the case of the Pawtucket spills described in this paper, the amount of initial contamination from tiny amounts of mercury adherent to the soles of footwear was sufficient to recontaminate apartments. Therefore it is not unreasonable to assume that far greater amounts of mercury from ritualistic spills would result in far greater cross contamination of apartments sharing common hallways.]

Heating/Ventilation Cycles

Heating cycles of 8 hours at 80 to 85 °F or higher then reducing the heat to 70 °F, and venting to the air for at least 2 hours were employed. At first, existing baseboard heating systems and open windows were used.

However, these existing systems were unable to consistently maintain the required temperature for decontamination. For the most contaminated building, portable heaters and negative air scrubbers with activated carbon filters accelerated vapor removal. This process was extremely efficient and effective. Monitoring of the scrubber outlets ensured that exhaust mercury vapor concentrations did not exceed 300 ng/m³.

Household & Personal Items

Some items were taken off site for additional decontamination. This off-site process involved bagging the personal items, heating them (90 to 140 °F for 24 hours), then ventilating them adequately before retesting. Items that could not be adequately decontaminated to less than 1,000 ng/m³ were disposed of as household waste. These items included refrigerators, sink/tub/shower drains, vacuums, mattresses and carpets. Personal items not able to be decontaminated included leather shoes, plastic toys and doormats/floormats.

All frozen and refrigerated food, and sink/tub/shower drains were discarded automatically. Items such as carpet, tile flooring, garbage disposals, furnace filters, vacuum cleaners, mattresses, leather shoes, sneakers, clothes and plastic toys were disposed of as hazardous waste when readings exceeded 10,000 ng/m³.

In general in this complex, porous materials were difficult if not impossible to decontaminate. One car was impounded and disposed of as hazardous waste. All other mercury sources present in the home (e.g.,

thermometers and thermostats) were removed and replaced with electronic versions. [When far greater amounts of elemental mercury are ritualistically sprinkled on floors, sometimes repeatedly, the contamination of porous materials is certain to be even greater.]



Overall, the highest readings were found in apartment entryways and the lowest in the bedrooms. Highest readings were generally found at floor level. [The reverse is true when mercury contamination is from ritualistic use, and is sprinkled in bedrooms, as in the case of the Cumberland, RI case described by Mercer et al., and Brannan et al.. Mercury emanations in bedrooms are far more likely to result in increased inhalation exposure than mercury in entryways.]

Structural Items & Surrounding Property

For the most contaminated building, disposed items included base moldings, plywood subfloors, baseboard heater covers, plumbing to the main drain stack, building entryway and concrete stairs. On the surrounding property, all plantings, grass, top soil and pavement were removed and replaced. [In this case, the deep-pocketed Southern Union gas company footed the bill. What entity will do so in the case of ritualistic mercury spills, where the perpetrator of the spill cannot be identified? Who will take responsibility for this level of decontamination?]

Reoccupancy

Within each building, post-heat measurements had to satisfy the screening protocol before clearance sampling was conducted; that is, 90% of readings had to be less than 300 ng/m³ and 100% less than 360 ng/m³. This was to account for the direct reading mercury vapor analyzer's ±20% instrumentation error. [Figure 1](#) illustrates the average mercury levels taken after a second round of cleaning and after each round of heating/ventilation. While initial readings (post-clean no. 2) were below 300 ng/m³, the readings after the first heat-vent cycle clearly shows the release of additional mercury vapor. In 43% of the units, mercury vapor levels increased post-heating over post-cleaning. Readings taken after the second heat-vent cycle were less than or equal to 100 ng/m³ with one exception.



[Figure 1](#)

Mercury Vapor Readings Post-Clean & Post-Heat Cycles

EHEALTH established the residential occupancy level (ROL) at 1,000 ng/m³. Using a modified [NIOSH \(2004\)](#) method 6009, 8-hour time-weighted average (TWA) hopcalite air samples tested below 500 ng/m³. Fifty-two percent were below the level of detection (200 ng/m³) ([Table 6](#)). It was concluded that no further remediation was required. EHEALTH issued a clearance letter for site reconstruction. Reoccupancy was completed Dec. 18.

ng/m ³ (ng/m ³) < 200 200-499 500	Entries	Units
< 200	4	0
200-499	20	14
500	1	12

[Table 6](#)

Distribution of Hopcalite Clearance Sampling Results (8-Hour TWA) in Building Entries & Units

Prior to residential reoccupation, all personal belongings, vehicles and frequented locations were screened for mercury vapors. Several personal items exceeded the ACSL and were disposed of with the owners' permission. EHEALTH tested 130 sites in 15 cities and towns across RI and MA, including 96 private residences, 23 institutions and 11 commercial properties, and found **extensive secondary contamination in two schools and four residences**. [Should we not expect to find similar or worse secondary contamination of schools and residences from ritualistic mercury contamination of homes?] School contamination was isolated from occupied areas while residences were evacuated until remediation and reconstruction were completed. By Dec. 27, all residents had returned to their apartments.

Biological Monitoring

Biological monitoring was not initiated at the time of evacuation. Initially, EHEALTH did not obtain residents' contact information. Sixty-four percent of residents voluntarily submitted blood samples within 30 days of first exposure. Ninetyone nonresidents at secondary mercury-impacted locations were voluntarily tested for total blood mercury. A month later, only 7% of these individuals voluntarily submitted random urine samples.

All individuals with blood mercury levels ≥10 µg/dL were advised by EHEALTH to followup with their healthcare providers. Specific test results cannot be disclosed here due to medical confidentiality. Blood samples were not speciated for organic and inorganic mercury, and urine mercury levels were not creatinine corrected.

Risk Communication

Regularly scheduled meetings were held between residents and representatives from RIDEM, EHEALTH and Southern Union to address residents' concerns. However, inconsistencies in the information provided by each agency confused residents. One-way, carefully orchestrated messages from Southern Union **served to erode public trust** [What sort of public trust can possibly exist when the first warning of the latent disaster posed by ritualistic mercury use was published in Nature on October 18, 1990, and when the ATSDR in March 1999 stated that "**There is an urgent need to obtain information on the levels of exposure from these practices to determine if children or adults are at risk.**" (Toxicological Profile for Mercury. p. 480). There is no reason for the public to place any trust in local, state, or federal agencies, nor in the environmental health community, who have been aware of ritualistic mercury contamination for over a quarter of a century, yet have done nothing of a substantive nature to assess the issue, let alone to address it.] in the gas company and, by association, the regulatory governmental agencies involved. Residents' anger, fears and frustration were clearly voiced at these meetings. During these meetings, residents' concerns centered around three questions:

1. **Is it safe?** [Is it safe for families to live in homes where mean weights of ~10 grams of mercury have been sprinkled on floors within the past several decades? See Carpi & Chen, ES&T, 2001?] According to the protocols established for this incident by state agencies and EPA, within each building, post-heat measurements had to satisfy the screening protocol before clearance sampling was conducted (i.e., 90% of readings had to be less than 300 ng/m³ and 100% less than 360 ng/m³ to account for the direct-reading mercury vapor analyzer's ±20% error margin). Subsequent to this screening, an 8-hour TWA hopcalite air sample was taken. If that sample was below 300 ng/m³, then the residents could return home safely. Once the site met these standards, the residence was considered safe for reoccupancy.
2. **Is it safe enough?** [There has been no virtually substantive attempt to measure mercury vapor levels emanating from ritualistic spills *inside* apartments. The only such case that I'm aware of was described in a cursory manner by Mercer et al. (*Pediatric Dermatology*, March 2012), by and Brannan et al. (*Pediatric Emergency Care*, August 2012). By coincidence, this case of a ritualistic mercury contaminated home, also occurred in Rhode Island, and was investigated in a cursory manner by the same RI DEQ and RI DOH as the Pawtucket case.] Residents asked, "Why isn't the level zero?" By modifying both air sampling and analytical methods, the level of detection was able to be lowered to 200 ng/m³. According to these protocols, it was safe enough. It is important to explain that the lowest detection level is the amount of airborne mercury that can be measured reliably.
3. **Is it right?** "If mercury is so hazardous, why are you saying it is safe to return when there is still mercury in our apartments?" As noted, according to these protocols, it was both safe and safe enough. Once the department of health issued a clearance letter for site reconstruction and reoccupancy to commence, there was no further state agency involvement. Once the property is reoccupied, there was no assurance that the apartments were not newly contaminated. The most prudent practice would be to apply the as low as reasonably achievable (ALARA) principle. ["If mercury is so hazardous," why has there been no substantive attempt to assess the tens of thousands of homes that are certain to be contaminated from magico-religious mercury spills?]

The concept of contamination is not an easy concept for the public to understand, particularly when there is an absence of sensory input. Although beads of mercury may have been visible on the pavement at the complex, no fire, no train wreck or chemical plant was emitting foul-smelling smoke. The initial vandalism incident had happened 3 weeks previously, and residents felt fine. In particular, extended latency periods with long-term health implications are very difficult to comprehend.

Recommendations

Analysis of this response suggests that modifications to assessment and decontamination procedures would increase the efficiency and expediency of future responses to elemental mercury-related incidents. These recommendations were made:

Assessment & Decontamination Procedures

1. Establish immediately and continue to enforce strict perimeter security.
2. Set up designated walking paths to avoid walking in contaminated areas.
3. Conduct and document monitoring identically to facilitate comparison of subsequent measurements and to minimize transcription errors, especially when multiple contractors are involved.
4. When external contamination is being brought into the residence (as opposed to the residence being the primary source of contamination), initially sample only the residential entry. If the entry is greater than or equal to ACSL, the residence fails. If the entry is less than ACSL, sample each room.
5. Take only floor-level readings during the initial assessment and remediation process to ascertain degree of contamination. In addition, take air samples in the breathing zone to ensure adequate worker protection.
6. Investigate use and efficacy of existing over-the-counter products containing selenium sulfide to decontaminate people and pets where elemental mercury contamination is suspected.
7. Initiate and maintain a registry that contains the contact information for all residents.
8. Remove the following items before heating/venting cycles: wall-to-wall carpet, J/P traps, garbage disposals, vacuum cleaners, shoes, plastic toys, and frozen and refrigerated food.
9. Remediate the most contaminated residences/rooms and all common areas first to minimize cross-contamination.
10. Employ two to three heating/venting cycles first, then identify remaining hot spots for decontamination/disposal. Use supplementary heaters with exhaust scrubbers.



Each contractor created and implemented a safety and health plan. RIDEM met with contractors regularly but did not coordinate their efforts. In addition, no third-party safety and health professional was on site to ensure that each contractor followed EPA remediation and sampling guidelines.

State & Federal Response Guidelines

1. Require an on-site CSP or CIH to oversee the safety/health aspects of remediation. Minimally, this individual should meet OSHA's definition of qualified person per 29 CFR 1910.120 and job specifications as to be determined by EPA and/or the state agency responsible for environmental management.

2. Establish a level of 300 ng/m³ for the ACSL (real-time) and the ROL (8-hour TWA) for residences in order to provide a greater margin of safety. These lower levels are both measurable and reasonably achievable. However, the lower ROL would require modifying and validating NIOSH air sampling method 6009.
3. To conservatively account for the ±20% error margin in direct reading instrumentation, require 90% of ACSL readings to be less than or equal to 240 ng/m³ and 100% to be less than or equal to 300 ng/m³.
4. EHEALTH (or similar state agency) should determine the need for clinical assessment and biological testing at the time of initial response. Collect blood and urine samples simultaneously; analyze the blood for speciated mercury with urinary mercury creatinine corrected.
5. More U.S.-population-based data are needed for mercury levels in blood and urine. Currently, mercury levels are tested only in women of child-bearing age and children age 6 and younger. It has been speculated that Rhode Islanders consume more fish than the U.S. population and, thus, would have higher blood levels. There is a need for state-specific biological and environmental background levels to confirm or disprove this perception.

Risk Communication

1. Consider the importance of **participatory discourse** when establishing and/or modifying response policies and procedures. [The source of ritualistic / cultural / magico-religious mercury contamination of housing is from members of the several Caribbean and Latino communities. They are essentially ignorant of the toxic sequelae of their intentional mercury spills. Their elites, including medical, environmental, legal, political, academic, and environmental justice personnel, are aware of the toxic potential of domestic mercury spills, but are too embarrassed that members of their own communities are fouling their own nests, and poisoning their own fetuses, infants, children and adult family members, and creating public nuisances for any subsequent occupants of their contaminated dwellings, as well as polluting the waterways their mercury-contaminated wastewater enters. As a consequence, there has been no "participatory discourse" on this issue, and quite the contrary, the several potential community representatives have been in denial of the issue, or simply ignored it.]
2. **Clearly identify and separate issues before implementing specific communication strategies to resolve them (Klinke & Renn, 2002).** [There can be no effective "communication strategies" without conclusive evidence that: a) Ritualistic mercury spills contaminate apartments; b) That mercury contaminated apartments result in mercury contamination of occupants; and c) That mercury contaminated occupants are poisoned by their domestic mercury vapor exposure, with a variety of ill effects, most problematically neurodevelopmental deficits. As in the case of the Surgeon General's 1964 landmark report on tobacco smoking and its sequelae, which provided convincing data that the public used to change their behavior. The ritualistic mercury user community, and the far larger mercury exposed community, have no such data at their disposal, nor to their health care providers, who in general, have no clue that these domestic mercury exposures are occurring.]
3. **Present a balanced form of communication for issues of complexity, uncertainty and ambiguity. Since the social amplification of the consequences of risk is defined by the cultural, social and individual structures and processes that shape the overall societal experience of risk, meaning is as important as the numbers themselves. Sometimes science alone is just not enough (Table 7).** [There is no uncertainty or ambiguity about the human health effects that result from prenatal, infantile, pediatric exposure to mercury vapor. However, there is no social amplification of risk if the exposed persons are either unaware that they are exposed, as is the case of the vast majority of those exposed to mercury vapor at second hand, as occupants of dwellings contaminated by prior occupants, as long ago as several decades, as described by Carpi & Chen (2001), or as recently as the immediately prior occupant, as described by Mercer et al. (2012), and Brannan et al. (2012). There is, however, a profound ignorance of these ritualistic mercury spills, their sequelae, and that the fact that although they are inspired by super-natural belief, their physiological effects on the human body, and in particular on the developing brain, are certain to be deleterious. This is, of course, why all of the very comprehensive and hence expensive, resources were expended in decontaminating the Lawn Terrace apartments.]

Less outrage (more safe)	More outrage (less safe)
Voluntary	Involuntary or coerced
Natural	Industrial or anthropogenic
Familiar	Unfamiliar/exotic
Not memorable	Memorable
Not dreaded	Dreaded
Chronic	Catastrophic
Knowable (detectable)	Unknown (not detectable)
Controlled by the individual	Controlled by others
Far	Unfar
Morally irrelevant	Morally relevant
Trustworthy sources	Untrustworthy sources

[Table 7](#)

Risk-Related Characteristics That Contribute to Public Outrage

Final Outcome

This incident displaced 140 residents for 3 months and cost Southern Union an estimated \$6.6 million.

[The January 1996 letter in the *American Journal of Public Health* "Mercury Use in Espiritismo: a Survey of Botanicas" by Zayas & Ozuah, states that in 1995, 35 of the 38 Bronx, NY botanicas sold between 25,000 and 155,000 ~10 gram units of mercury, of which 29.3% were recommended to be sprinkled on floors of homes. At only one unit per home, this would result in between ~8,000 to ~50,000 homes being contaminated with ~10 grams of mercury in one year. Please contrast this with the 140 Pawtucket residents displaced for 3 months, by comparatively minute amounts of mercury tracked in on the soles of their footwear!] The youths allegedly responsible for contaminating the apartment complex were arrested and processed through the juvenile courts. As a result, information regarding their adjudication was not released to the public.

On Oct. 15, 2008, Southern Union was convicted by jury of knowingly storing liquid mercury without obtaining the proper permits in violation of federal law ([U.S. Department of Justice, 2008](#)). On Oct. 2, 2009, a federal judge fined Southern Union \$18 million with 2 years' probation during which time the company had to prove it had an environmental compliance program and performed an environmental audit ([Mulvaney, 2009](#)).

One year later, the First U.S. Circuit Court of Appeals in Boston upheld this conviction and fine ([Neronha, 2010](#)). A civil suit brought by residents against the company was settled out of court. The company paid an undisclosed sum of money to the residents ([Bramson, 2009](#)).

Conclusion

This study's recommendations were based on the ALARA principle. Recommendations were matched to key findings. Data showed that lower action levels were achievable with currently available remediation methods. Modification to NIOSH method 6009 needs validation. Further research is recommended to assess the procedural efficacy and long-term outcomes of these recommendations. Efforts to modify EPA regulations and guidelines should be initiated as well. PS

Hazards of Mercury

Mercury can exist in three forms: **elemental (Hg⁰)**, inorganic (IHg or Hg⁺¹, Hg⁺²) and organic [e.g., ethyl-, phenyl- and methyl-mercury (MeHg)]. Humans have daily contact with both naturally occurring and anthropogenic sources of elemental mercury ([U.S. Geological Survey, 2000](#)). Mercury has been measured at or above detectable levels in air, water and food; in places where people live, work, play and learn; and in products purchased and equipment used ([EPA, Great Lakes Region, 1998](#)). Outdoor urban air has approximately 10 to 20 nanograms per cubic meter (ng/m³) mercury concentration ([Singhvi, Mehra & McGuire, 2004](#)). In 1998, EPA established an air reference concentration (RfC) for elemental mercury at 300 ng/m³ ([EPA, 1999](#)). A reference

concentration is an estimate of continuous inhalation exposure in a human population (including vulnerable subpopulations) that is likely to be without appreciable risk of deleterious effects during a lifetime ([EPA, 1998](#)).

Residential elemental mercury sources include thermometers, thermostats, heating oil, coal, regulators for gas delivery systems, switches, fluorescent light bulbs, automobiles and cell batteries ([U.S. Geological Survey, 2000](#)). **Additionally, mercury has been incorporated into certain sociocultural behaviors and ritual practices that can occur within a residence** ([EPA, 2002](#)). [A far more comprehensive set of citations on this issue can be accessed by typing the key words < **mercury Santeria** > into your favorite search engine or Google Scholar.] Little data are available regarding background levels of mercury in residences. One environmental survey of 12 New York residences suggested that indoor sites may have higher concentrations than those outdoors ([Carpi & Chen, 2001](#)). [Carpi & Chen found that small amounts of mercury spills from broken clinical thermometers (approximately 0.7 grams) were persistent for a dozen years, and that they were likely to persist for several decades. When unit weights of ~10 grams are sprinkled on floors, and not, as is the case of broken thermometers cleaned up, the mercury can be expected to persist for far longer.] However, the study suggested that short-term monitoring was not sufficient to adequately characterize the degree of background residential contamination due to large seasonal changes.

Mercury persists both in the environment and in the human body. Elemental mercury vaporizes at room temperatures. As a result, exposure to elemental mercury occurs primarily through inhalation and to a lesser extent through skin absorption or (secondary) ingestion. Eighty percent of inhaled Hg⁰ enters the bloodstream then travels to the brain and kidneys where it accumulates ([Cherian, Hursh, Clarkson, et al., 1978](#)). Exposure to high levels of Hg⁰ vapor can cause symptoms such as irritation to the lining of the mouth, lungs and airways, increased blood pressure and heart rate, and/or nausea, vomiting and diarrhea. Even a small amount of Hg⁰ remaining in a room after a spill can continue to vaporize slowly over time resulting in sustained elevated air concentrations of mercury and chronic exposure. Early symptoms of chronic mercury exposure include loss of sensation in the extremities and constriction of the visual field. More severe symptoms include emotional lability (irritability, shyness, nervousness), tremors, muscle incoordination, memory loss, deafness and eventually, total incapacitation and death ([Agocs & Clarkson, 1995](#)). Depending on the dose and the individual, the latency period between exposure and the appearance of symptoms may span weeks. Because Hg⁰ is slowly excreted from the body, it accumulates in the kidneys, which are particularly sensitive to damage. **Little to no information is available regarding health effects associated with low-level long-term mercury exposures** ([ATSDR, 1999](#)).

As mercury bioaccumulates in the body, there is the potential for transfer to progeny. Mercury crosses the placenta easily. Fetal exposure results in more severe disease manifestation than adult exposure. Effects can range from subtle decrements in development or intelligence to acute and chronic developmental disabilities such as cerebral palsy, kidney, immune and/or reproductive system disorders and an increase in the likelihood of heart disease. Fetal damage has been reported in cases where their mothers did not exhibit overt symptoms ([Clarkson, Magos & Greenwood, 1972](#).) [We can be absolutely certain that there is a latent epidemic of the "subtle decrements in development or intelligence," in ritualistically contaminated homes, resulting from the fetal exposure the author describes.]

Among infants and toddlers, postnatal exposures occur through lactation [The 2002 EPA Report (p. 3) the author cites, describes a [Dominican] woman who had a breast milk mercury level of 57 µg/L, presumably from her daily use for two years prior to her delivery, of a mercury laced cologne, used as love potion.] and general hand-to-mouth contact. Additionally, children are closer to the floor or ground where mercury vapor concentrations tend to be higher. Acrodynia is seen in children often. It is an idiosyncratic hypersensitivity hallmarked by bright pink or red hands and feet with peeling skin ([Weinstein, & Bernstein, 2003](#)).

Mercury can be detected in blood, urine, feces, exhaled breath and hair. Laboratory analysis of blood and urine mercury can be speciated (organic vs. non-organic) ([Langworth, Elinder, Gothe, et al., 1991](#)). According to 2004 data collected on the U.S. population by the National Health and Nutritional Examination Survey, the

geometric mean for total blood mercury was 0.797 µg/L, 95% CI [0.703, 0.903] with the 95th percentile equal to 4.90 µg/L, 95% CI [4.30, 5.50] and the geometric mean for total urinary mercury was 0.447 µg/L, 95% CI [0.406, 0.492] with the 95th percentile equal to 3.19 µg/L, 95% CI [2.76, 3.55] ([CDC, 2011](#)). Epidemiological studies have demonstrated health effects with blood concentrations less than 10 µg/L ([Axelrad, Bellinger, Ryan, et al., 2007](#)).

Six Rs of Emergency Response to Mercury Contamination

Referral. The roles, **responsibilities** and authorities of **local, state and federal** agencies are delineated. This section addresses consent for entry and access to property. [Local, state and federal agencies have all abdicated their responsibilities in addressing all aspects of ritualistic mercury contamination of housing and the larger aquatic environment.]

Reconnaissance. Procedures are detailed for **initial assessment** of the extent and degree of contamination present in the residences. The Agency for Toxic Substances and Disease Registry (ATSDR) action level for cleanup is 1,000 ng/m³ ([Singhvi, Mehra & McGuire, 2004](#), p. 9). Level C PPE (air-purifying respirator) is required for air levels greater than or equal to 25,000 ng/m³ (Singhvi, Mehra & McGuire, p. B-v). [Cursory assessments have been made, as by the NJDEP's 2003 and 2007 studies in Union City and West New York, NJ, as reported on the NJDEP web site, and in *Environmental Health Perspectives* (January 2006, Garetano et al.; and Garetano et al., *Science of the Total Environment* 2008)]

Relocation. Residents should be temporarily relocated if assessment and clearance screening level (ACSL) is > 10,000 ng/m³ real-time or > 1,000 ng/m³ 8-hour time-weighted average ([Table 1](#), p. 51). A step-by-step process is outlined for screening residents' clothing prior to relocation. [How would it be possible to relocate the number of homes contaminated in one year in the Bronx, NY, where from 25,000 to 155,000 9 gram mean weights of elemental mercury were sold in one year, with >29% recommended to be sprinkled on floors? What thought has been given for the need to set standards for portable mercury vapor filters?]

Removal. The lengthy process of documenting and decontaminating residences, their contents and surrounding property is provided. Action levels for soil remediation are referenced ([Table 2](#), p. 51). Disposal characterization is detailed (e.g., waste manifests).

Replacement. Residential restoration should return each residence to its prior condition and repair damage secondary to decontamination procedures. EPA has the legal authority to recover costs under Superfund although it is reluctant to do so when it involves a residence. In this case, the gas company assumed full financial responsibility. Replacement is not discussed further in this article. [What is to be done when there is no deep-pocketed gas company to pay for the decontamination and replacement of contaminated belonging?]

Reoccupation. Again, the roles, **responsibilities** and authorities of local, state and federal agencies are delineated. It addresses by whose authority residential reoccupation is allowed. Typically, representatives from all of these agencies meet with residents prior to and following reoccupation. The residential occupancy level is 1,000 ng/m³ as an 8-hour time-weighted average. When postdecontamination levels by direct reading instrumentation are within acceptable limits, 8-hour time-weighted samples are taken. If these samples are less than 1,000 ng/m³, then reoccupation can occur. [Where will all of the necessary " representatives from all of these agencies" come from when very large numbers of dwellings are found to be contaminated from the Bronx, to Union City, to Miami, to Boston, to Chicago, to Lawrence, to San Juan?]

Note. From Mercury Response Guidebook, by U.S. EPA Region 5, 2001, Washington, DC: Author.

Direct Reading Instruments

At the time of the incident, several direct reading real-time instruments were market-available for detecting elemental mercury vapor ([Rader Environmental Services, 2008](#)). However, only three were used in this incident: the Jerome MVA, Lumex 915+ and Lumex RA-915 Light.

The Jerome Mercury Vapor Analyzer (Jerome MVA) was accurate only when mercury vapor concentrations were greater than 1,000 ng/m³. Interferences to its accuracy included smoke, nitrogen and sulfide compounds. The Jerome MVA could not be used to sample ambient air at levels 300 ng/m³ or less.

The Lumex 915+ conducted real-time monitoring (one per second), data collection and data logging in real-time with storage capability to save separate files. It featured an on-board display with a set point level alarm. Its standard multipath mode had levels of detection 2 to 20,000 ng/m³. For higher concentrations, the single path mode was employed with levels of detection 500 to 200,000 ng/m³.

The Lumex 915+ instrument is not to be confused with Lumex RA-915 Light which had levels of detection 100 to 100,000 ng/m³. Both the Lumex 915+ and RA-915 Light had $\pm 20\%$ instrumentation error. High humidity (greater than 95% at 35 °C or 95 °F) gave false positive readings ([Ohio Lumex, 2001](#)). Periodic readings with on/off cycling were performed with and without the glass filter to check for mercury contamination of the sampling tube itself. The glass filter was replaced if the difference between these two readings was greater than 10%. Filter checks were performed initially and after every 4 hours. The instruments' major limitation was the 4-hour rechargeable battery that could not be removed from unit for charging. [Where will the necessary instrumentation come from? Where will the operators of said instrumentation be found? The only NIOSH certified instrument to be the equivalent to the 6009 protocol is the Lumex 915+, currently selling for ~\$25,000 and in short supply for the enormity of the contamination under discussion.]

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Biography

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[Use the key words <**mercury Santeria**> for more information on this issue.]

Module 5

Cultural Uses of Mercury



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Module 5

Cultural Uses of Mercury

Cultural Uses of Mercury

K E Y M E S S A G E S

- Mercury has been used for hundreds of years for cultural and religious reasons and has, on occasion, had mythological associations.
- A number of practices exist today that use mercury, including: Santería (an Afro-Hispanic belief system), Palo Mayombé (Caribbean), Candomblé (Afro-Brazilian), Voodoo (Afro-Haitian), Espiritismo (Puerto Rican) and Yoruba Orisha (Afro-Hispanic). Mercury is also used in Hindu practice as a major constituent of Parad, from which religious relics are made.
- In some cases, mercury is injected subcutaneously, intravenously or intramuscularly to improve athletic prowess or protect users from evil.
- Exposures resulting from cultural uses depend to a large extent on the nature of the practice: swallowing elemental mercury capsules and inhalation of mercury vapour are the most common exposure routes.



W H Y I S T H I S I M P O R T A N T T O Y O U ?

Direct and prolonged exposure to mercury is a human health hazard and has an impact on the downstream environment.

People using mercury for cultural uses are often unaware of mercury's toxicity and associated risks.

Often the mercury vapour exposure from cultural use is second-hand, from magico-religious mercury use by a prior occupant of a dwelling.

The storage, transport and handling of mercury for these purposes can impose risk by introducing opportunities for spills and vapour releases.



W H A T C A N Y O U D O ?

✓ **For the Public**

- ✓ Be aware of dangers of mercury and the risks of mercury use! There is no safe way to use mercury and scientists have found no safe mercury level in the human body.
- ✓ Help raise awareness about mercury exposure risks with your family and in your community.
- ✓ Dispose of mercury-containing products separately, not with other trash.

✓ **For Governments and Health Care Workers**

- ✓ Identify communities or cultural groups that use mercury for cultural/religious purposes and investigate the impacts.
- ✓ Embark on a public awareness campaign for mercury reduction with targeted cultural groups, engaging health professionals and cultural/spiritual leaders.
- ✓ Develop and distribute informative material for the public on mercury and its toxic effects.
- ✓ Ask the mass media (newspapers, magazines, radio and television) to help you educate the community on the dangers of the use of mercury.
- ✓ Encourage reduced mercury use through voluntary promotional initiatives or through regulation of production and sales.
- ✓ Measure mercury concentrations in dwellings and commercial establishments in the affected area and use this information to communicate risks.
- ✓ Take part in the UNEP Global Mercury Partnership. Go to www.chem.unep.ch/mercury/partnerships/new_partnership.htm for more information.

Cultural Uses of Mercury

What is the history of mercury use for cultural purposes?

- > Mercury has been used for hundreds of years for cultural and religious reasons and has, on occasion, had mythological associations.
- > Mercury was brought to the New World by Spaniards for use in extracting gold from ores. Its amalgamating properties led to a belief that mercury attracts good fortune, wealth and love.
- > Other characteristics of mercury have led to a range of beliefs. Some people believe its characteristic sudden movements mean it will furnish remedies more quickly. It is also said to prevent evil or bad luck from sticking to a person because it seems slippery.
- > China's first emperor, Qin Shi Huang Di (260 BC – 210 BC) took mercury pills in an attempt to achieve eternal life, but instead he died from mercury poisoning.
- > In the 13th through 17th centuries, mercury was used in India in elixirs believed to confer immortality.

What are common cultural practices that use mercury?

Mercury has long been used in ethnocultural or religious practices such as Santería (an Afro-Hispanic belief system), Palo Mayombé (Caribbean), Candomblé (Afro-Brazilian), Voodoo (Afro-Haitian), Espiritismo (a spirit-focused belief system native to Puerto Rico) and Yoruba Orisha (Afro-Hispanic).

Most of these uses are associated with African roots, and many of them are related the Roman Catholic teachings of Spaniards. The use of mercury – also known as azogue (Spanish) or vidajan (Creole) for such practices – has been documented in many countries, including by minority populations in large cities. Mercury is also used in revised Wiccan (witchcraft) practices. Mercury is employed in Hindu practices as a major constituent of Parad, from which religious relics are made.

How and why is the mercury used?

Sometimes mercury is used to facilitate or to hasten desired results, such as:

- > Sprinkled on the floor to protect occupants of a car, home etc.. This is done in children's rooms, and in cars to prevent accidents.
- > Used with water and a mop for spiritual cleaning of a dwelling.
- > Added to oil lamps and candles which are then burned to ward off evil spirits; bring good luck, love or money; or to hasten other spells.
- > Used in various ways to cast love spells (Greenberg, 1999), heal or dispel evil influences.

Cultural and/or religious practices with mercury use include:

- > Carried in amulets, ampoules, vials or pouches worn around the neck or carried on the person.
- > Used to make religious statues or other objects, such as parad shiving (see Case Study 14).

- > Applied to the skin or used in bathwater, perfumes, lotions or soaps.
- > Injected subcutaneously to ward off evil and protect against exposure to disease while traveling (Prasad, 2004) or intramuscularly to help athletes build muscle mass (Celli and Khan, 1976).
- > Ingested for superstitious or medicinal purposes (Greenberg, 1999), including steeped in raw milk before the milk is drunk.
- > Mercury and mercury compounds are also used in culturally specific medicinal compounds, such as Asian medicines (see Module 4).

Some examples of risks associated with common practices:

Mercury capsules: Mercury capsules known as Azogue, sold in religious stores, are sometimes used as a Mexican folk remedy for indigestion or gastroenteritis blockages (*empacho*). Ingestion of the heavy, mobile liquid mercury is believed by practitioners to dislodge gastrointestinal blockages, particularly in children (Geffner and Sandler, 1980). Mercury ingestion generally leads to both digestive and renal problems and neurological symptoms. Diagnosis is complicated by the similarity between the symptoms from consuming the mercury and the symptoms of the illness it is used to treat.

Mercury use in the home: Mercury is sometimes kept in containers, such as pots or cauldrons, in the home. These are sometimes sealed but other times left open to “purify” the air. In the Palo belief system a significant quantity of mercury is one of the most important of many special and mystical ingredients when brewing up the cauldron which is believed to have a spirit in it. Sometimes mercury is mixed with water, ammonia or camphor, or a magnet is placed in it. Other times it is kept in a gourd or piece of fruit. The most common use of elemental mercury in Latin American and Caribbean communities in New York City is in a container in the home. This practice is found in more than 30% of homes in Latin American communities and in about 25% of homes in Caribbean communities in New York City (Johnson, 1999).

A major problem associated with ritualistic mercury use, is the contamination of wastewater. Johnson reported that 27% of users dumped their residual, unused mercury down the drain, and more enters wastewater from the practices of putting mercury in bathwater and mopping the floor with it, when the mercury in the bottom of the bucket is inadvertently dumped out with the residual soapy water. Additionally, absorbed and ingested mercury is excreted in urine and faeces.

What are the risks?

- > Exposures resulting from cultural uses depend to a large extent on the nature of the practice:
 - The most common exposure pathway is through inhalation of mercury vapours. This is of particular concern especially in closed spaces. Approximately 75-85%

of inhaled mercury vapour is absorbed and enters the bloodstream. Any mercury held in unsealed containers or spilled will result in mercury vapour.

- In particular, the practice of sprinkling mercury in a car can result in very high vapour concentrations, especially after the closed vehicle has stood in the sun on a warm day. Similarly, vapour concentrations in contaminated dwellings can increase in colder weather, when the room or apartment is closed and possibly heated (Johnson, 1999).

- > Special risks are involved in the storage, transport and handling of mercury which introduce opportunities for spills and exposures, both immediate and longer-term.
- > Unsuspecting persons can be poisoned by exposure to mercury spilled by previous residents of their dwelling. Mercury can linger in cracks in the floor, carpeting, dirt and even concrete for many years, slowly volatilizing.

What can you do?

- > Be aware of the risks of mercury use and share this knowledge with your family and friends!
- > Always dispose of mercury and mercury containing products as separate hazardous waste (see Module 1).
- > Non-governmental organizations can initiate a public awareness campaign with governments to investigate this issue and with cultural groups in your area who are known to use mercury.

What can healthcare professionals do?

- > Be aware of the symptoms of mercury poisoning and how patients might be exposed to mercury.
- > Help bring together community groups and leaders and government (for example the Health Department) personnel to discuss ways to publicize the risks associated with mercury.
- > Design and distribute information posters on mercury exposure, risks and symptoms in the local language for public gathering places and see that these are placed in clinics, doctors' offices and hospitals.

What can governments do?

- > Measure contamination levels at locations where mercury is sold and/or used to measure and communicate risks.
- > Meet with members of cultural groups using mercury, engaging health professionals, cultural/spiritual leaders and local distributors (e.g., botánicas owners and sanadores) in the discussion. These meetings can serve as a forum to understand the use of mercury and share ideas. They could also be useful forums to explore alternatives to mercury use.
- > Develop printed informative material based on documented risks, such as leaflets or posters, on mercury exposure and toxicity in local languages.

- > Distribute or post these in targeted public places, transportation centers, government buildings, hospitals, schools and particularly stores that sell mercury.
- > Encourage mercury use reduction by promoting voluntary initiatives or regulating import or sales of mercury and mercury containing products.
- > Require that mercury be labeled as hazardous and that signs regarding exposure risks be posted at point-of-sale.
- > Prohibition of the sale of mercury can be effective in reducing mercury use for cultural purposes and is most effective with inspection follow-ups. Prohibition can lead to a significant increase in cost of mercury capsules on the black market (see Case Study 13).
- > Secure proper waste management facilities. See Module 1.

The UNEP Global Mercury Partnership is open to new partners. Joining the partnership can be an excellent opportunity to network with experts and build capacity.

What are the potential barriers in changing cultural practices?

For many ritual and cultural uses of mercury, safer substitutes are identified and readily available.

There is a general lack of awareness of the risks of mercury use as well as available alternatives amongst cultural leaders, communities, health care professionals and people who sell the products.

It is usually difficult at first for individuals to consider changing long-standing cultural or traditional practices. Furthermore, experience has shown that even if users recognize that mercury is considered toxic, they may believe that its ritualistic or supernatural nature renders it harmless or the user beyond harm. Strong messaging including concrete examples demonstrating the risks can have an impact.

Convincing cultural leaders of mercury risks is of uppermost importance. Trusted health care leaders can play a big role in relaying the message.

Example: The use of mercury in Santería

Santería is an Afro-Hispanic belief system. The use of mercury for Santería and other spiritual practices has been reported in the Dominican Republic, Cuba and other Caribbean islands, Suriname, Belize, Trinidad, Jamaica, Peru, Ecuador, Argentina, Brazil, Colombia, Mexico, Venezuela, Guyana, France, the Netherlands and Puerto Rico (Wendroff, 1991). Santería was actively suppressed in Cuba after Fidel Castro's revolution – particularly during the 1960s. However, oppression has now largely ended, and the popularity and practice of Santería has increased in Cuba during the 1990s.

Mercury is used in a variety of ways that pose a poisoning risk to users. Some typical uses identified in Santería are:

- Place mercury in water or in a tea bag with some coins.
- Carry a capsule of mercury in an amulet on a chain or between two coins in a wallet.
- Throw a capsule of it in bath water.
- Swallow a capsule of mercury mixed with holy water.
- Burn mercury in a candle.
- Wash the house with water containing mercury to purify it.
- Put mercury under the bed.
- Swallow a capsule of mercury, sometimes mixed with water, for stomach ailments or cancer.
- Take mercury with beer to increase virility.
- Rub a mixture of mercury and alcohol on an area affected by arthritis.
- Put mercury in a glass near a candle so that it evaporates quickly.
- Mix mercury with other ingredients for use in sorcery.
- Apply mercury to the skin during massages.

In communities and regions where these practices are prevalent, mercury is typically sold in capsules from “botánicas” or “yerberías,” which are small, privately owned shops that sell popular religious articles, as well as a variety of products believed to have medicinal or healing properties. Mercury is sometimes sold in gelatin capsules with a capacity of more than 13.5 g, but which typically contain 8-9 g mercury (Riley et al., 2001). A capsule can contain up to 10 times more mercury than one thermometer. Small glass jars, plastic bottles or plastic bags are sometimes used as well, containing as much as 65 grams of mercury.

Most customers arrive at botánicas with a prescription received from a sanador. Besides selling products, some botánicas offer spiritual inquiry services for clients. Usually these consultations are offered in a room inside the botánicas that has been designed for that purpose. Generally, the person that offers these consultations is a spiritualist medium or santero. Some botánica owners function as counselors for their clients and offer social and emotional support.

See Case Study 14# for further information.

Example: Hindu mercury use in Parad

Parad is an amalgamation of mercury and other metals that is used to make relics for worship of God in the Hindu tradition. Solidifying mercury is an ancient Vedic science. 'Dharmidhar Samhita' (scripture) has prescribed sixteen steps through which elemental mercury has to pass to purify it and bring out its beneficial qualities before it is alloyed (mixed with other metals) to make parad, which can be molded into any solid form. Parad is traditionally made of silver and mercury, but it is now often made of mercury and tin, with trace amounts of other metals.

To people who practice this, the benefits of parad are said to be many and varied, and may include:

- Vaastu or Tanrik dosh nivaran (removes bad luck from the workplace or home).
- Curing a range of diseases.
- Warding off evil spirits.
- Establishing an inner spiritual balance.
- Increasing willpower.
- Stopping nightmares.
- Resolving marriage problems.

In Hindu culture, it is traditionally believed that the worship of parad shivling (an abstract image of God, an icon or statue) will destroy sins. It is said in Brahma Purana scripture that any person who worships parad idols devotedly will receive full worldly pleasures - glory, honor, high office, fame, sons, grandsons and learning - and upon death attain supreme destination (salvation). Various religious objects are made of parad and sold in markets in India. These include: beads worn around the waist or neck, amrit (a nectar or ambrosia) cup, Shivling (an abstract image or statue of God), Lakshmi (a representation of the Goddess of wealth), and a Ganesh (an idol of Lord Ganesh). India has many Shiva temples, which have parad shivlings. Sales of parad statues, jewelry and other artifacts through websites and television are widespread in India.

See Case Study 15# for further information.

CASE STUDY 14:
PUERTO RICO: PROHIBITION OF MERCURY SALES IN BOTÁNICAS

In 1991 the Puerto Rico Department of Consumer Affairs (DACO) issued an order prohibiting the distribution and sale of mercury capsules.

The order followed a visit to a botánica by an inspector of the Department of Health. In the botánica, the inspector bought two capsules of silvery liquid. These capsules were analyzed by the Department of Health and it was confirmed that they contained mercury. The average price of a mercury gelatin capsule in botánicas at the time the research was done was \$US 2.00, although some botánicas charged as much as \$5.00. (The price of the mercury had increased significantly after the Department of Health prohibited its sale in botánicas. Prior to this regulation a capsule of mercury could be bought for \$US 0.75.)

DACO intervened at the level of the two mercury distributors in Puerto Rico. The presidents of both companies denied having sold capsules of mercury to owners of botánicas. They agreed to impose a fine of \$10,000 on people who violated this prohibition.

Despite the fact that most botánicas owners are aware of the regulation, a significant percentage of botánicas continue to sell capsules of mercury. In a study that followed the prohibition 132 botánicas were identified in 74 towns:

- The majority of the botánicas were located in the coastal areas. 41% of 76 botánicas visited by researchers sold mercury. Researchers found that botánica owners were reluctant to speak about mercury because of a ban on sales, and most initially denied that they had any for sale.
- In 7 cases, owners of botánicas that did not carry mercury sent the customers to others who did sell it or recommended that they obtain it from thermometers.
- About 50% of botánicas owners knew that the sale of mercury was prohibited because it can damage health, and they adhered to the restrictions. These owners do not have mercury for sale and they tell customers who ask that the sale of mercury has been prohibited because it is dangerous for health.
- Some owners of botánicas know that the sale of mercury is prohibited, but continue selling it to their clients. Some of these owners advise customers on how to utilize mercury in a way that they say is not toxic. These people very likely continue selling mercury because they are not convinced that mercury is toxic or because they have a financial interest in selling mercury that outweighs its negative health effects. Other owners of botánicas sell mercury knowing its toxic potential but believing that if it is used in a certain way the mercury will not do damage – these owners tend to advise customers on the toxic potential of mercury.

- According to owners, candles are the most frequently sold product.

Santería spiritual leaders (sanadores), in the western part of Puerto Rico were interviewed to find out how they use mercury and whether they know of its risks. Of the 24 interviewed, all but two admitted knowing of mercury use, six knew that it was dangerous to health, and four knew that its sale was prohibited.

Botánicas are an important source of information and support system for a significant part of the Puerto Rican population. They perform important therapeutic, economic and social functions in the community. Their name evokes uses of medicines and natural substances, and their context implies traditions of healing and popular medicine. The botánicas have a great variety of products available.

While some botánica owners function like sanadores, others merely sell products for a profit whether they believe in their effectiveness or not. Some attribute the effectiveness of the products to the faith that the user places in them and confess that most of the products they sell are simply not necessarily effective.

SOURCE: This is based on a case study from a Spanish language document: Course notes Sistemas Folclóricos de Ayuda, Módulo 8: El mercurio: <http://www.uprm.edu/socialsciences/sfaenlinea/id15.htm>. By Mario Núñez-Molina. Universidad de Puerto Rico, Recinto Universitario de Mayagüez

CASE STUDY 15: TOXICS LINK STUDIES MERCURY LEVELS IN PARAD

The Indian non-governmental organization Toxics Link initiated a study of Parad following the creation of a 500 kg Parad shivling at Siddha Ashram. Their objective was to identify the extent of this traditional use of mercury and the cultural significance of Parad, identify possible sources of Parad in the region, determine the material composition of Parad, and test the leaching behavior of Parad in milk (this test was chosen because the shiv puja involves immersion and bathing of shivling by milk and drinking of that milk by the devotees). Studies revealed that the primary chemical composition of Parad by % weight is tin 74.8 %, mercury 24.9 %, and other metals at low percentages (including silver at 0.04%). Tests showed that mercury in Parad does indeed leach in milk and water, potentially exposing anyone who drinks milk that has been used to soak Parad relics or drinks from Parad cups.

Toxics Link is working to raise awareness and educate the public directly on the toxicity of mercury.

Acknowledgement

This case study was provided by Toxics Link, a non-governmental organization in India. Toxics Link emerged from a need to establish a mechanism for disseminating credible information about toxics in India, and raising the level of toxics debate. Currently it has a main office in New Delhi as well as offices in Mumbai and Chennai. "The Ritual Use of Mercury," an audio (broadcast) segment.

“The Ritual Use of Mercury,” an audio (broadcast) segment.
For more information see:

Fact Sheet – National Association of County and City Health Officials.
<http://www.naccho.org/topics/environmental/mercury/upload/MercuryFactsheet.pdf>

The UNEP Global Mercury Partnership:
www.chem.unep.ch/mercury/partnerships/new_partnership.htm

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Governments have agreed that there is sufficient evidence of significant adverse impacts from mercury and mercury compounds to warrant action on mercury. This publication was developed to raise awareness in certain countries and regions amongst stakeholders on the effects of mercury on human health and the environment. It is hoped that it will assist citizens, governments and health care workers to build support and the capacity to take action to reduce or eliminate mercury uses, release, and exposure to mercury.

This is one of five modules.

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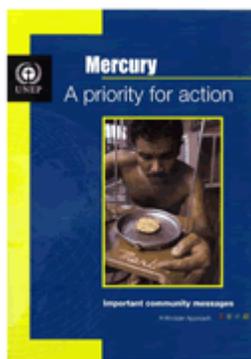
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Harmful Substances

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Awareness Raising Package



This publication is intended to raise awareness amongst stakeholders of the effects of mercury. It is designed for the use of government officials, community leaders, and/or workers to provide information intended to contribute in building public support and capacity to take preventive actions.

This publication exists also in [French](#) and [Spanish](#). [I've attached the Spanish version.]

<http://www.unep.org/hazardoussubstances/Mercury/MercuryPublications/ReportsPublications/AwarenessRaisingPackage/tabid/4022/language/en-US/Default.aspx>

The document can be used in a number of ways:

- for reference,
- to train staff,
- to present or hand out as copies directly from the toolkit,
- to develop materials specific to your community.

How is it laid out?

The package begins with a [user's guide](#), providing information on general awareness raising activities for businesses.

The package includes an [introductory booklet](#) which provides a general overview of the mercury situation.

There follows a set of 5 modules that describe different aspects of the mercury issue:

[MODULE 1: Mercury in Products and Wastes](#)

[MODULE 2: Mercury and Industry](#)

[MODULE 3: Mercury Use in Artisanal and Small Scale Gold Mining](#)

[MODULE 4: Mercury Use in Healthcare Settings and Dentistry](#)

[MODULE 5: Cultural Uses of Mercury](#)

The organization of the modules allows you to go directly to the topic of interest. Each module provides information on the mercury issue and what people need to know in order to recognize and reduce sources of exposure, providing examples of how some mercury exposure situations have been handled.

A series of associated presentations have been prepared for use in awareness raising activities.

Introduction to the Mercury Issue

Module 1: Mercury in Products and Wastes

Module 2: Mercury and Industry

Module 3: Mercury Use in Artisanal and Small Scale Gold Mining (for Government Officials)

Module 3: Mercury Use in Artisanal and Small Scale Gold Mining (for Miners)

Module 4: Mercury Use in Healthcare Settings and Dentistry (for Government Officials)

Module 4: Mercury Use in Healthcare Settings and Dentistry (for Healthcare Workers)

Module 5: Cultural Uses of Mercury

If you believe anything is missing or develop additional materials you think would be useful, please contact the mercury team at the following email address: mercury@unep.org

www.chem.unep.ch/mercury/awareness_raising.../G_01-16_BD.pdf

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Module 5

Cultural Uses of Mercury

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KEY MESSAGES

- Mercury has been used for hundreds of years for cultural and religious reasons and has, on occasion, had mythological associations.

■ A number of practices exist today that use mercury, including: **Santería** (an Afro-Hispanic belief system), **Palo Mayombé** (Caribbean), Candomblé (Afro-Brazilian), Voodoo (Afro-Haitian), **Espiritismo** (Puerto Rican) and **Yoruba Orisha** (Afro-Hispanic). Mercury is also used in Hindu practice as a major constituent of Parad, from which religious relics are made.

■ In some cases, mercury is injected subcutaneously, intravenously or intramuscularly to improve athletic prowess or protect users from evil.

■ **Exposures resulting from cultural uses depend to a large extent on the nature of the practice:** swallowing elemental mercury capsules and **inhalation of mercury vapour** are the most common exposure routes.

WHY IS THIS IMPORTANT TO YOU?

Direct and prolonged exposure to mercury is a human health hazard **and has an impact on the downstream environment.**

People using mercury for cultural uses are often unaware of mercury's toxicity and associated risks.

Often the mercury vapour exposure from cultural use is second-hand, from magico-religious mercury use by a prior occupant of a dwelling.

The storage, transport and handling of mercury for these purposes can impose risk by introducing opportunities for spills and vapour releases.

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For the Public

Be aware of dangers of mercury and the risks of mercury use! There is no safe way to use mercury and scientists have found no safe mercury level in the human body.

Help raise awareness about mercury exposure risks with your family and in your community.

Dispose of mercury-containing products separately, not with other trash.

For Governments and Health Care Workers

Identify communities or cultural groups that use mercury for cultural/religious purposes and investigate the impacts.

Embark on a public awareness campaign for mercury reduction with targeted cultural groups, engaging health professionals and cultural/spiritual leaders.

Develop and distribute informative material for the public on mercury and its toxic effects.

Ask the mass media (newspapers, magazines, radio and television) to help you educate the community on the dangers of the use of mercury.

Encourage reduced mercury use through voluntary promotional initiatives or through regulation of production and sales.

Measure mercury concentrations in dwellings and commercial establishments in the affected area and use this information to communicate risks.

Take part in the UNEP Global Mercury Partnership. Go to www.chem.unep.ch/mercury/partnerships/new_partnership.htm for more information.

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What is the history of mercury use for cultural purposes?

- > Mercury has been used for hundreds of years for cultural and religious reasons and has, on occasion, had mythological associations.
- > Mercury was brought to the New World by Spaniards for use in extracting gold from ores. Its amalgamating properties led to a belief that mercury attracts good fortune, wealth and love.
- > Other characteristics of mercury have led to a range of beliefs. Some people believe its characteristic sudden movements mean it will furnish remedies more quickly. It is also said to prevent evil or bad luck from sticking to a person because it seems slippery.
- > China's first emperor, Qin Shi Huang Di (260 BC – 210 BC) took mercury pills in an attempt to achieve eternal life, but instead he died from mercury poisoning.
- > In the 13th through 17th centuries, mercury was used in India in elixirs believed to confer immortality.

What are common cultural practices that use mercury?

Mercury has long been used in ethnocultural or religious practices such as Santería (an Afro-Hispanic belief system), Palo Mayombé (Caribbean), Candomblé (Afro-Brazilian), Voodoo (Afro-Haitian), Espiritismo (a spirit-focused belief system native to Puerto Rico) and Yoruba Orisha (Afro-Hispanic).

Most of these uses are associated with African roots, and many of them are related the Roman Catholic teachings of Spaniards. The use of mercury – also known as azogue (Spanish) or vidajan (Creole) for such practices – has been documented in many countries, including by minority populations in large cities. Mercury is also used in revised Wiccan (witchcraft) practices. Mercury is employed in Hindu practices as a major constituent of Parad, from which religious relics are made.

How and why is the mercury used?

Sometimes mercury is used to facilitate or to hasten desired results, such as:

- > **Sprinkled on the floor** to protect occupants of a car, home etc.. This is done in children's rooms, and in cars to prevent accidents.
- > Used with water and a mop for spiritual cleaning of a dwelling.

> Added to oil lamps and candles which are then burned to ward off evil spirits; bring good luck, love or money; or to hasten other spells.

> Used in various ways to cast love spells (Greenberg, 1999), heal or dispel evil influences.

Cultural and/or religious practices with mercury use include:

> Carried in amulets, ampoules, vials or pouches worn around the neck or carried on the person.

> Used to make religious statues or other objects, such as parad shivling (see Case Study 14).

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> Applied to the skin or used in bathwater, perfumes, lotions or soaps.

> Injected subcutaneously to ward off evil and protect against exposure to disease while traveling (Prasad, 2004) or intramuscularly to help athletes build muscle mass (Celli and Khan, 1976).

> Ingested for superstitious or medicinal purposes (Greenberg, 1999), including steeped in raw milk before the milk is drunk.

> Mercury and mercury compounds are also used in culturally specific medicinal compounds, such as Asian medicines (see Module 4).

Some examples of risks associated with common practices:

Mercury capsules: Mercury capsules known as Azogue, sold in religious stores, are sometimes used as a Mexican folk remedy for indigestion or gastroenteritis blockages (*empacho*). Ingestion of the heavy, mobile liquid mercury is believed by practitioners to dislodge gastrointestinal blockages, particularly in children (Geffner and Sandler, 1980). Mercury ingestion generally leads to both digestive and renal problems and neurological symptoms. Diagnosis is complicated by the similarity between the symptoms from consuming the mercury and the symptoms of the illness it is used to treat.

Mercury use in the home: Mercury is sometimes kept in containers, such as pots or cauldrons, in the home. These are sometimes sealed but **other times left open to “purify” the air. In the Palo belief system a significant quantity of mercury is one of the most important of many special and mystical ingredients when brewing up the cauldron which is believed to have a spirit in it.** Sometimes mercury is mixed with water, ammonia or camphor, or a magnet is placed in it. Other times it is kept in a gourd or piece of fruit. The most common use of elemental mercury in Latin American and Caribbean communities in New York City is in a container in the home. This practice is found in more than 30% of homes in Latin American communities and in about 25% of homes in Caribbean communities in New York City (Johnson, 1999).

A major problem associated with ritualistic mercury use, is the contamination of wastewater. Johnson reported that 27% of users dumped their residual, unused mercury down the drain, and more enters wastewater from the practices of putting mercury in bathwater and mopping the floor with it, when the mercury in the bottom of the bucket is inadvertently dumped out with the residual soapy water. Additionally, absorbed and ingested mercury is excreted in urine and faeces.

What are the risks?

> Exposures resulting from cultural uses depend to a large extent on the nature of the practice:

- **The most common exposure pathway is through inhalation of mercury vapours.** This is of particular concern especially in closed spaces. Approximately 75-85% **p. 6** of inhaled mercury vapour is absorbed and enters the bloodstream. Any mercury held in unsealed containers or spilled will result in mercury vapour.

- In particular, the practice of sprinkling mercury in a car can result in very high vapour concentrations, especially after the closed vehicle has stood in the sun on a warm day. **Similarly, vapour concentrations in contaminated dwellings can increase in colder weather, when the room or apartment is closed and possibly heated (Johnson, 1999).**

> Special risks are involved in the storage, transport and handling of mercury which introduce opportunities for spills and exposures, both immediate and longer term.

> Unsuspecting persons can be poisoned by exposure to mercury spilled by previous residents of their dwelling. Mercury can linger in cracks in the floor, carpeting, dirt and even concrete for many years, slowly volatilizing.

What can you do?

> Be aware of the risks of mercury use and share this knowledge with your family and friends!

> Always dispose of mercury and mercury containing products as separate hazardous waste (see Module 1).

> Non-governmental organizations can initiate a public awareness campaign with governments to investigate this issue and with cultural groups in your area who are known to use mercury.

What can healthcare professionals do?

> **Be aware of the symptoms of mercury poisoning and how patients might be exposed to mercury.**

> **Help bring together community groups and leaders and government (for example the Health Department) personnel to discuss ways to publicize the risks associated with mercury.**

> **Design and distribute information posters on mercury exposure, risks and symptoms in the local language for public gathering places and see that these are placed in clinics, doctors' offices and hospitals.**

What can governments do?

> Measure contamination levels at locations where mercury is sold and/or used to *measure* and communicate risks.

> Meet with members of cultural groups using mercury, engaging health professionals, cultural/spiritual leaders and local distributors (e.g., botánicas owners and sanadores) in the discussion. These meetings can serve as a forum to understand the use of mercury and share ideas. They could also be useful forums to explore alternatives to mercury use.

> **Develop printed informative material based on documented risks, such as leaflets or posters, on mercury exposure and toxicity in local languages.**

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> **Distribute or post these in targeted public places, transportation centers, government buildings, hospitals, schools and particularly stores that sell mercury.**

> Encourage mercury use reduction by promoting voluntary initiatives or regulating import or sales of mercury and mercury containing products.

> Require that mercury be labeled as hazardous and that signs regarding exposure risks be posted at point-of-sale.

> **Prohibition of the sale of mercury can be effective in reducing mercury use for cultural purposes and is most effective with inspection follow-ups. Prohibition can lead to a significant increase in cost of mercury capsules on the black market (see Case Study 13).**

> Secure proper waste management facilities. See Module 1.

The UNEP Global Mercury Partnership is open to new partners. Joining the partnership can be an excellent opportunity to network with experts and build capacity.

What are the potential barriers in changing cultural practices?

For many ritual and cultural uses of mercury, safer substitutes are identified and readily available.

There is a general lack of awareness of the risks of mercury use as well as available alternatives amongst cultural leaders, communities, health care professionals and people who sell the products.

It is usually difficult at first for individuals to consider changing long-standing cultural or traditional practices. Furthermore, experience has shown that even if users recognize that mercury is considered toxic, they may believe that its ritualistic or supernatural nature renders it harmless or the user beyond harm.

Strong messaging including concrete examples demonstrating the risks can have an impact.

Convincing cultural leaders of mercury risks is of uppermost importance. Trusted health care leaders can play a big role in relaying the message.

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Example: The use of mercury in Santeria

Santería is an Afro-Hispanic belief system. The use of mercury for Santería and other spiritual practices has been reported in the Dominican Republic, Cuba and other Caribbean islands, Suriname, Belize, Trinidad, Jamaica, Peru, Ecuador, Argentina, Brazil, Colombia, Mexico, Venezuela, Guyana, France, the Netherlands and Puerto Rico (Wendroff, 1991). Santería was actively suppressed in Cuba after Fidel Castro's revolution – particularly during the 1960s. However, oppression has now largely ended, and the popularity and practice of Santería has increased in Cuba during the 1990s.

Mercury is used in a variety of ways that pose a poisoning risk to users. Some typical uses identified in Santería are:

- Place mercury in water or in a tea bag with some coins.
- Carry a capsule of mercury in an amulet on a chain or between two coins in a wallet.
- Throw a capsule of it in bath water.
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- Burn mercury in a candle.
- Wash the house with water containing mercury to purify it.
- Put mercury under the bed.
- Swallow a capsule of mercury, sometimes mixed with water, for stomach ailments or cancer.
- Take mercury with beer to increase virility.
- Rub a mixture of mercury and alcohol on an area affected by arthritis.
- **Put mercury in a glass near a candle so that it evaporates quickly.**
- Mix mercury with other ingredients for use in sorcery.
- Apply mercury to the skin during massages.

In communities and regions where these practices are prevalent, mercury is typically sold in capsules from “botánicas” or “yerberías,” which are small, privately owned shops that sell popular religious articles, as well as a variety of products believed to have medicinal or healing properties. Mercury is sometimes sold in gelatin capsules with a capacity of more than 13.5 g, but which typically contain 8-9 g mercury (Riley et al., 2001). A capsule can contain up to 10 times more mercury than one thermometer. Small glass jars, plastic bottles or plastic bags are sometimes used as well, containing as much as 65 grams of mercury.

Most customers arrive at botánicas with a prescription received from a sanador. Besides selling products, some botánicas offer spiritual inquiry services for clients. Usually these consultations are offered in a room inside the botánicas that has been designed for that purpose. Generally, the person that offers these consultations is a spiritualist medium or santero. Some botánica owners function as counselors for their clients and offer social and emotional support.

See Case Study 13# for further information.

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- Establishing an inner spiritual balance.
- Increasing willpower.
- Stopping nightmares.
- Resolving marriage problems.

In Hindu culture, it is traditionally believed that the worship of parad shivling (an abstract image of God, an icon or statue) will destroy sins. It is said in Brahma Purana scripture that any person who worships parad idols devotedly will receive full worldly pleasures - glory, honor, high office, fame, sons, grandsons and learning - and upon death attain supreme destination (salvation). Various religious objects are made of parad and sold in markets in India. These include: beads worn around the waist or neck, amrit (a nectar or ambrosia) cup, Shivling (an abstract image or statue of God), Lakshmi (a representation of the Goddess of wealth), and a Ganesh (an idol of Lord Ganesh). India has many Shiva temples, which have parad shivlings. Sales of parad statues, jewelry and other artifacts through websites and television are widespread in India.

See Case Study 14# for further information.

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CASE STUDY 14:

PUERTO RICO: PROHIBITION OF MERCURY SALES IN BOTÁNICAS

In 1991 the Puerto Rico Department of Consumer Affairs (DACO) issued an order prohibiting the distribution and sale of mercury capsules.

The order followed a visit to a botánica by an inspector of the Department of Health. In the botánica, the inspector bought two capsules of silvery liquid. These capsules were analyzed by the Department of Health and it was confirmed that they contained mercury. The average price of a mercury gelatin capsule in botánicas at the time the research was done was \$US 2.00, although some botánicas charged as much as \$5.00. (The price of the mercury had increased significantly after the Department of Health prohibited its sale in botánicas. Prior to this regulation a capsule of mercury could be bought for \$US 0.75.)

DACO intervened at the level of the two mercury distributors in Puerto Rico. The presidents of both companies denied having sold capsules of mercury to owners of botánicas. They agreed to impose a fine of \$10,000 on people who violated this prohibition.

Despite the fact that most botánicas owners are aware of the regulation, **a significant percentage of botánicas continue to sell capsules of mercury. In a study that followed the prohibition 132 botánicas were identified in 74 towns:**

- **The majority of the botánicas were located in the coastal areas. 41% of 76 botánicas visited by researchers sold mercury. Researchers found that botánica owners were reluctant to speak about mercury because of a ban on sales, and most initially denied that they had any for sale.**
- **In 7 cases, owners of botánicas that did not carry mercury sent the customers to others who did sell it or recommended that they obtain it from thermometers.**
- About 50% of botánicas owners knew that the sale of mercury was prohibited because it can damage health, and they adhered to the restrictions. These owners do not have mercury for sale and they tell customers who ask that the sale of mercury has been prohibited because it is dangerous for health.
- **Some owners of botánicas know that the sale of mercury is prohibited, but continue selling it to their clients. Some of these owners advise customers on how to utilize mercury in a way that they say is not toxic. These people very likely continue selling mercury because they are not convinced that mercury is toxic or because they have a financial interest in selling mercury that outweighs its negative health effects. Other owners of botánicas sell mercury knowing its toxic potential but believing that if it is used in a certain way the mercury will not do damage – these owners tend to advise customers on the toxic potential of mercury.**

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CASE STUDY 14

- According to owners, candles are the most frequently sold product.

Santería spiritual leaders (sanadores), in the western part of Puerto Rico were interviewed to find out how they use mercury and whether they know of its risks. Of the 24 interviewed, all but two admitted knowing of mercury use, six knew that it was dangerous to health, and four knew that its sale was prohibited.

Botánicas are an important source of information and support system for a significant part of the Puerto Rican population. They perform important therapeutic, economic and social functions in the community. Their name evokes uses of medicines and natural substances, and their context implies traditions of healing and popular medicine. The botánicas have a great variety of products available.

While some botánica owners function like sanadores, others merely sell products for a profit whether they believe in their effectiveness or not. Some attribute the effectiveness of the products to the faith that the user places in them and confess that most of the products they sell are simply not necessarily effective.

SOURCE: This is based on a case study from a Spanish language document: Course notes Sistemas Folclóricos de Ayuda, Módulo 8: El mercurio: <http://www.uprm.edu/socialsciences/sfaenlinea/id15.htm>. By Mario Núñez-Molina. Universidad de Puerto Rico, Recinto Universitario de Mayagüez

CASE STUDY 15:

TOXICS LINK STUDIES MERCURY LEVELS IN PARAD

The Indian non-governmental organization Toxics Link initiated a study of Parad following the creation of a 500 kg Parad shivling at Siddha Ashram. Their objective was to identify the extent of this traditional use of mercury and the cultural significance of Parad, identify possible sources of Parad in the region,

determine the material composition of Parad, and test the leaching behavior of Parad in milk (this test was chosen because the shiv puja involves immersion and bathing of shivling by milk and drinking of that milk by the devotees). Studies revealed that the primary chemical composition of Parad by % weight is tin 74.8 %, mercury 24.9 %, and other metals at low percentages (including silver at 0.04%). Tests showed that mercury in Parad does indeed leach in milk and water, potentially exposing anyone who drinks milk that has been used to soak Parad relics or drinks from Parad cups. Toxics Link is working to raise awareness and educate the public directly on the toxicity of mercury.

Acknowledgement

This case study was provided by Toxics Link, a non-governmental organization in India. Toxics Link emerged from a need to establish a mechanism for disseminating credible information about toxics in India, and raising the level of toxics debate. Currently it has a main office in New Delhi as well as offices in Mumbai and Chennai. “The Ritual Use of Mercury,” an audio (broadcast) segment.

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CASE STUDY 14 & 15

“The Ritual Use of Mercury,” an audio (broadcast) segment.

For more information see:

Fact Sheet – National Association of County and City Health Officials.

<http://www.naccho.org/topics/environmental/mercury/upload/MercuryFactsheet.pdf>

The UNEP Global Mercury Partnership:

www.chem.unep.ch/mercury/partnerships/new_partnership.htm

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Mercury Policy Project

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MERCURY POISONING PROJECT

www.mercurypoisoningproject.org

Key Words < mercury Santeria >

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March 20, 2016

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Subject: Failure of NYCHA, NYCDOHMH, NYSDOH and other city, state and federal agencies to protect NYCHA tenants from exposure to and poisoning by, mercury vapor

Dear United States Attorney/s,

This complaint is one allied to your current investigation of the New York City Housing Authority (NYCHA), and NYCHA's failure to protect its tenants from exposure to lead emanations from peeling paint, as well as from plumbing and possibly from soil in building gardens. To some extent the New York City Department of Health and Mental Hygiene (DOH) is involved in this issue, for failing to adequately monitor children's blood lead levels, and for failing to assess lead levels in housing.

My complaint involves both NYCHA, as well as DOH. Specifically their **failure to adequately assess mercury vapor levels on NYCHA housing**, where it is believed to be emanating primarily from ritualistic mercury spills by both current and prior occupants, as described in detail in the enclosures to this letter, and in internet-web links to this letter.

The rationale for this desire to assess mercury vapor levels originated with my research initially published in 1990, documenting the sale and magico-religious use of elemental mercury in New York City's (NYC) Caribbean and Latino communities (Wendroff, *Nature*, 1990 - enclosed). Most importantly, the next publication on this topic better quantified the sale and presumed use of mercury by means of a universe sample Bronx botanicas. In 1995, there were 41 botanicas located in the Bronx, and 38 of them sold elemental mercury for ritualistic use. 35 of the 38 were able to provide an estimate of how many ~10 gram units of mercury they sold per day, and an environmental scientist member of the U.S. Environmental Protection Agency's Task Force on Ritualistic Uses of Mercury calculated that in 1995, these 35 botanicas sold between 25,000 and 155,000 units of mercury, the vast majority unlabeled. This study found that ~30% of botanica mercury sales were recommended to be sprinkled on floors. (Zayas & Ozuah, *American Journal of Public Health*, 1996 - enclosed) This is the basis of my concern, as these spills persist in flooring for several decades, all the while emanating developmentally neurotoxic levels of mercury vapor in occupied dwellings, where the mercury is disturbed by domestic activities, which disrupt any atmospheric corrosion, and allow the release of mercury vapor, some 80% of which is inhaled is absorbed, to poison the developing brain as well as other organ systems. (Wendroff, *The Lancet Neurology*, 2014 - enclosed)

The NYCDOHMH has been aware of the likelihood of mercury contamination of both public and private housing in New York City since September 1990, and NYCHA has been aware of this environmental health threat to their tenants since at least 2002. Yet both NYCHA and the DOH have refused to assess mercury vapor levels in public housing developments serving large Caribbean and Latino populations as was strongly recommended by the U.S. Agency for Toxic Substances and Disease Registry in 1999:

A unique exposure pathway that has received little research attention is the exposure to children from religious and ethnic uses in homes and cars or in remedies containing metallic mercury (ATSDR 1997; Johnson [in press]; Wendroff 1990, 1991). In some religious practices of Latin American or Caribbean origin, there are traditional rituals or remedies that involve mercury. These include intentional sprinkling of liquid elemental mercury on the floor, burning candles made with mercury, using mercury in baths, adding it to perfume, or wearing small containers of mercury around the neck for good luck. **There is an urgent need to obtain information on the levels of exposure from these practices** to determine if children or adults are at risk. Mercury vapor concentrations may be much higher after use during the winter months when the heat is turned on and the windows are closed, so data that reflect a variety of possible exposure scenarios are also needed. (Toxicological Profile for Mercury ATSDR March **1999** - excerpts enclosed)

My concerns over these domestic mercury vapor exposures in NYCHA apartments (enclosed) letter of September 28, **2002**) were ignored by NYCHA's Deputy Director of Technical Services in his (enclosed) letter to me of September 25, **2002**. These dates seem out of sequence, but they are not, as you can see from: (Clarke, Deputy Director, Technical Services, NYCHA, Letter to Wendroff, **2002** - enclosed)

More specifically, Judith Enck, EPA Region 2 Regional Administrator wrote to me (enclosed) on July 10, **2010** recommending that housing be assessed for elevated mercury vapor levels, and specifically suggesting NYCHA housing:

Studying the prevalence of ritualistic Hg use and its potential for contaminating residential -dwellings .poses logistic challenges, both legal and cultural. Access agreements would be needed to gain entry into residential dwellings. EPA has explored accessing vacant **NYC Housing Authority** apartments as a way to obviate this requirement. (Enck, EPA R2 Administrator, Letter to Wendroff, 2010 (enclosed)

EPA's rationale failed to convince NYCHA to allow EPA to perform said mercury vapor assessments, which would have been performed by EPA at no cost to NYCHA. NYCHA's Director of Technical Services, wrote to me after allegedly consulting with the DOH, the New York State Department of Health (NYSDOH), and the U.S. Centers for Disease Control (CDC). He concluded that urine mercury level (UML) surveys of children in Chicago and New York

indicated that there is neither widespread nor significant exposure from ritualistic mercury use, we do not feel it is necessary to conduct a separate NYCHA study. (Ponce, Director, Technical Services Department, NYCHA, Letter to Wendroff, 2010 - enclosed)

This flies in the face of the ATSDR's above quoted statement that "**There is an urgent need to obtain information on the levels of exposure from these practices,**" as well as EPA R2's statement that

Air monitoring data in the hallways of buildings in areas with a large Afro-Caribbean population in NJ have provided strong evidence that **at least 2% of apartments in these areas** have an ongoing or historic presence of mercury, consistent with such cultural use, ... (enclosed July 10, **2010** letter and **FY11 Regional Applied Research Effort Proposal**)

The "these areas" that EPA referred to are just across the Hudson River from Manhattan, in Union City and West New York, NJ, with large Caribbean and Latino communities similar to those present in New York City, especially in The Bronx, NY. I have enclosed five documents describing two studies of indoor mercury vapor levels in apartment buildings in Union City and West New York, conducted by the New Jersey Department of Environmental Protection (NJDEP). Their authors concluded that:

Elevated hallway levels appear to result from specific apartments. These results suggest higher concentrations of mercury vapor in apartments. **These results are consistent with intentional mercury use inside at least some of the buildings surveyed,** but may also be consistent with recent data on indoor background levels resulting from historic spills.

Additional indoor air sampling is warranted to better characterize mercury levels in apartments. Comparable sampling in areas with different ethnic characteristics is needed to better understand the relative contributions of intentional/cultural mercury use, and unintentional mercury appliance breakage. (Stern et al. NJDEP May, **2003** - enclosed)

Comparison of levels in the reference community to outdoor levels suggests an elevated background of indoor Hg vapor possibly from a history of unintentional Hg spills. However, the significantly increased levels above this background that were observed in the study communities strongly suggest (but do not prove) the prevalence of intentional cultural use of Hg. These findings call attention to the potential for significant exposure in areas with likely cultural use of Hg.

These measurements represent only a signal of exposure and exposure cannot be estimated from these data. Nonetheless, it is reasonable to assume that exposure levels in the actual residential spaces (i.e., apartments) exceed those measured in the common areas. **These results point to the need for the development of a public health policy to reduce exposures resulting from cultural use of Hg.** (Stern et al. NJDEP September, 2007 - enclosed)

In some instances, we were able to locate the source, but we could not specifically attribute the elevated levels of mercury vapor to cultural use or other specific mercury releases. However, **these findings provide sufficient evidence of indoor mercury source(s) to warrant further investigation.**

Although our data are not intended as estimates of residential exposure to mercury vapor, they do indicate that, compared with outdoor levels, **such exposures are likely in a significant proportion of multifamily residential buildings in an area with known cultural uses of mercury.**

These findings are consistent with the hypothesis of cultural use of mercury, but not definitive. The elevated mercury vapor concentration found in botanicas is also consistent with its availability for cultural use.

These measurements were not made in areas that directly reflect exposure, nor, for the most part, do they measure concentration at the emission source. Therefore, **these measurements could underestimate mercury concentration at the point of long-term exposure.**

Whether exposure to elevated mercury vapor arises from intentional cultural uses or from unintentional breakage and spillage of mercury-containing equipment, **these exposures pose the potential for adverse health effects and should be addressed.**

Such contamination may be widespread and would likely be independent of cultural factors. Based on reports on the manner in which mercury may be used for cultural purposes, and our present findings, **we also recommend expanded screenings in areas where mercury may be used for cultural purposes** with the inclusion of suitable control locations. Although cultural obstacles may be present that may impede a direct approach to assessing human exposure to mercury vapor as a result of cultural practices and its relevance to public health, we believe further evaluations in the field will ultimately shed light on this elusive issue. (Garetano et al, *Environmental Health Perspectives* January 2006 - enclosed)

After controlling for factors that might influence Hg⁰ vapor levels, **the most plausible explanation for greater Hg⁰ levels in the study area is a relationship to cultural use of mercury.** None of the measured levels exceeded the ATSDR minimum risk level for residences of 200 ng/m³ Hg⁰ although levels in living quarters might be greater than those in the common areas.

We believe the signals provided by spot measurements of mercury vapor concentration in building common areas are a relevant screening tool to identify the presence of mercury release within a building regardless of its source. **Obtaining data on the relationship between mercury levels in common areas versus those in living areas could be a useful next step.**

We believe the “signals” of Hg⁰ release we observed in the communities where cultural use is likely provide empirical data that mercury is dispersed in more residential buildings in these communities than elsewhere. **Our findings** are consistent with previous reports (Wendroff, 2005; [Wendroff, Environmental Practice, 2005 - enclosed] Riley et al., 2001; U.S. EPA, 2002), and **lead us to conclude that some individuals in these communities may be exposed to elevated Hg⁰ vapor from cultural practices. Considering the turnover in apartment habitation, current residents may be unknowingly exposed to residual mercury from prior spills or practices.**

We believe our findings merit targeted public health intervention including culturally appropriate educational outreach, voluntary biomonitoring, and air monitoring for purposes of exposure assessment where indicated, in communities where cultural mercury use is likely. (Garetano et al, *Science of the Total Environment*, 2008 - enclosed)

Elemental mercury is used in a variety of superstitious and cultural practices. These practices involve **intentional dispersal of mercury within residential buildings** by individuals who believe this will provide some benefit or ward off harm but may represent **an insidious source of mercury exposure**.

We determined that cultural mercury use is a likely source of exposure for a small but noteworthy percentage of individuals in communities where there is such use.

We hypothesize that elevated levels of mercury vapor are present in residential buildings in communities that engage in cultural use of mercury compared with outdoors. We further hypothesize that elevated levels can serve as a signal of significant cultural use in addition to unintentional breakage and spillage from other sources.

Although our data are not intended as estimates of residential exposure to mercury vapor they do indicate that, compared with outdoor levels, such exposures are likely in a significant proportion of multifamily residential buildings in an area with known cultural uses of mercury.

Our... findings are consistent with the hypothesis of cultural uses of mercury, but not definitive. The **elevated mercury vapor concentration found in botanicas is also consistent with its availability for cultural use.**

these measurements could underestimate mercury concentration at the point of long-term exposure. ... In most buildings surveyed, including those with the highest mercury vapor concentration, windows were open.

Whether exposure to elevated mercury vapor arises from intentional cultural uses or from unintentional breakage and spillage of mercury-containing equipment, **these exposures pose the potential for adverse health effects and should be addressed.**

Based on reports on the manner in which mercury may be used for cultural purposes, and our present findings, **we also recommend expanded screenings in areas where mercury may be used for cultural purposes** with the inclusion of suitable control locations.

After controlling for a number of factors that might influence Hg⁰ vapor levels, **the most plausible explanation for greater Hg⁰ vapor levels in the study area is cultural use of mercury.**

Although the magnitude of exposure to Hg⁰ vapor from cultural use is unknown, **the hazard of Hg⁰ vapor is well established and it is detectable years after small spills** from objects such as a fever thermometer (Carpi and Chen 2001; von Muhlendahl 1990). With larger spills, significant concentrations of Hg⁰ vapor may persist for decades (Sasso et al. 1996). **This presents the specter of exposure to Hg⁰ in residences from either unintentional or intentional Hg⁰ releases without knowledge of such exposure. Wendroff (2005) contends cultural mercury use has created such a problem. Based on the described manner and frequency of mercury use by some individuals this contention is not without basis.**

We cannot attribute the greater prevalence of elevated mercury vapor levels in this area or in the primary study community to cultural use with absolute certainty, but **we have no alternate explanation.**

When we examine these data in context with the prior literature, previous and ongoing biomonitoring programs, **there is no choice other than to acknowledge some percentage of individuals are needlessly and possibly unknowingly exposed to Hg⁰ vapor because of the cultural or folk use of mercury. This includes residents of apartments where mercury was used culturally by prior residents.**

While noting sub-clinical neurological findings from low-level Hg⁰ vapor exposure, Heyer et al. (2004) put forth the supposition, **“It is possible that elemental mercury may follow the history of lead, eventually being considered a neurotoxin at extremely low levels.”**

... we feel strongly that the value, 20µg/L, and the word “normal” should only appear together in a historical context. [cf. Ozuah et al, *Ambulatory Pediatrics*, 2003 - enclosed]

The detection of elevated Hg⁰ vapor levels in residential buildings and botanicas supports the contention that mercury is available and released in residential buildings by cultural use.

In summary we conclude:

- 1. Hg⁰ vapor levels in the common areas of residential buildings in communities that use mercury for cultural purposes are significantly greater than those outdoors.**
- 2. Hg⁰ vapor levels are significantly greater in the common areas of residential buildings in communities that use mercury for cultural purposes compared to those in communities where the use of Hg⁰ is unlikely.**
- 3. Hg⁰ vapor exposure from cultural mercury use is likely in a small but noteworthy percentage of households in the study area.**

Recommendations for Public Health Action

The prevalence of cultural mercury use and the likelihood of exposure to Hg⁰ vapor at levels of public health concern warrant specific actions to address this use in communities where this practice exists. Though the extent of public health action might vary based on the prevalence of cultural use and associated Hg⁰ exposure, the following recommendations are relevant to the study communities surveyed in this research.

- 1. Culturally appropriate educational outreach activities, using written materials or other media that addresses sources of mercury, its health hazards, and resources for individuals who may be exposed are required. Educational materials must be accessible to individuals without deliberate action to seek information regarding mercury.**
- 2. Health care providers should be provided with educational materials and guidance regarding biomonitoring.**
- 3. Public health clinics and appropriate community-based clinics should provide urine mercury screening to those individuals that reasonably believe they are exposed, regardless of their ability to pay for this analysis.**
- 4. Local public health officials should have the capability, individually or regionally, to conduct mercury vapor monitoring with sensitive instruments. Monitoring in residences should be offered to all individuals with urine mercury above population norms. Public health officials should consider monitoring in all residences that request it.**

Recommendations for Additional Research

- 1. In other communities where there is cultural mercury use, air-monitoring surveys similar to that in Chapter 2 may be useful where deliberate public health action is deferred due to a lack of information regarding the prevalence of these practices.** (Doctoral thesis Excerpts, 2006 - enclosed)

The five documents quoted are all based on two studies conducted in New Jersey. Several additional studies were performed here in New York, and I will now summarize their findings and recommendations, in chronological order, insofar as they strongly suggest that some, albeit unknown number of NYCHA apartments

are certain to be contaminated with developmentally neurotoxic levels of mercury vapor, and hence need to be assessed for their potential to poison NYCHA tenants.

There seems ample justification for a programme to measure mercury vapour levels and to test exposed individuals. (Wendroff, *Nature* **1990** - enclosed)

Our survey shows that **mercury is quite easy to purchase, and the manner of use may create situations of constant exposure to potentially high levels of mercury vapors in the immediate atmosphere.** Of course, **more research is needed. In particular, explorations of mercury levels in inner-city communities** should include adherents of spiritualism as well as **non adherents since the latter may be exposed unwittingly to mercury poisoning by residing in apartments and homes previously inhabited by mercury sprinkling tenants.** (Zayas & Ozuah, *American Journal of Public Health*, **1996** - enclosed)

I have earlier cited the ATSDR's **1999 Toxicological Profile for Mercury** (excerpts enclosed

<<http://www.fda.gov/ohrms/dockets/ac/06/briefing/2006-4218b1-19-white-paper-draft-Appendix-G1-08.pdf>>)

The results suggest that elemental **mercury is ever present in the living environment of frequent users who are almost certainly receiving high and continuous doses.**

when that mercury user vacates the property, the **new occupants are unwittingly exposed to mercury for many months.**

The present study [Bronx, Manhattan, Brooklyn] suggests that a comprehensive study of the religious and ethnic uses of elemental mercury should be undertaken **including indoor air measurements. Such a study should be given high priority** and with the full support of the Latin American and Caribbean communities. (Johnson, *Population and Environment* **1999** - enclosed)

The findings of this pilot study indicate that mercury exposure is ongoing in this population of children. Comparable populations are extant in cities throughout the United States. Prior work identified ritualistic use of elemental mercury as a possible source of environmental mercury exposure in this community. However, the full scope of sources and ramifications of mercury among these [Bronx, NY] children require more extensive study. (Ozuah et al, *Ambulatory Pediatrics*, **2003** - enclosed)

All pediatric mercury levels measured in this study were well below a level considered to be of medical concern.

One subject at the Bronx clinic had a mercury result of 24.0 µg mercury/l urine—a New York state reportable level (levels >20 µg mercury/l urine). The NYC DOHMH attempted without success to contact the family for follow-up; the address provided by the parent did not exist, the telephone was not in service, and the child had never before been seen by the clinic. A multiple directory search by last name and first name of the parent yielded no working telephone or address in New York City. Yet the questionnaire data for this participant identified no source of mercury exposure. (Rogers et al, *Journal of Urban Health*, **2007**
< <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2430136/> >)

Note that although the authors state that all pediatric mercury levels were below levels of concern, they then went on to state that one *was* above their level of concern, (20 micrograms per liter), at 24 µg/L, and that this

child could (conveniently) not be located for further assessment of his home. The reader should note that the aforementioned **2003** study by Ozuah et al.

considered urinary Hg levels **above 5 µg/L** to be elevated. Although there are no firmly established background levels for urinary Hg in children, published data indicate that the vast majority of unexposed children should have urinary Hg levels below 5 µg/L.

We found that 5% of children in this study had unsuspected elevated urinary Hg levels. These findings, in a group of inner city children, have some ramifications. Published reports indicate that dental personnel with **urinary Hg measurements below 4 µg/L have subtle preclinical deficits in cognition, motor function, and mood.** A substantial number of children in our study had urinary Hg levels above 4 µg/L. This is potentially significant because neurodevelopmental deficits have been shown to be more prevalent among inner-city minority children. **Thus if present in the local environment, elemental mercury may be a contributing factor to the deficits observed in inner-city, low-income minority children.**

To repeat, Garetano, in his enclosed and previously cited **2006** doctoral dissertation, stated that

the [urinary mercury] value, 20µg/L, and the word “normal” should only appear together in a historical context.

The United Nations Environment Programme, specifically recommended that governments

Measure mercury concentrations in dwellings and commercial establishments in the affected area and use this information to communicate risks. (UNEP Module 5: Cultural Uses of Mercury 2008 - excerpts enclosed enclosed, < <http://www.unep.org/chemicalsandwaste/Mercury/ReportsandPublications/AwarenessRaisingPackage/tabid/4022/Default.aspx> >)

The EPA's **2002** Task Force on Ritualistic Uses of Mercury recommended

Fate and transport studies of mercury in indoor air to better relate cultural use to acute and long-term exposure levels, and to develop models to predict indoor concentrations and residence times. **Air measurements in vehicles, residences and botanicas are needed** to validate these models and **measure typical exposure levels stemming from cultural and religious uses.** (EPA, Task Force on Ritualistic Uses of Mercury Report, 2002 - <<http://nepis.epa.gov/Adobe/PDF/90100100.pdf>>)

Yet despite the enormous potential for permanent brain damage, nothing has been done to take these recommended air measurements of mercury vapor levels.

In **2009**, the ATSDR's Mercury Workgroup wrote that

Some Caribbean religions and folk healers use mercury for religious or ceremonial purposes [Wendroff 2005]. The ceremonial uses of mercury include applying it to the skin, adding it to candles, or sprinkling it around the home. Elemental mercury is easily dispersed into fine beads that sink into carpets, furniture, cracks in the floor, or other porous materials (Figure 1a, 1b). Mercury tracked from room to room produces widespread contamination throughout the house. These practices can potentially expose practitioners and their children. **Following indoor spills, mercury can persist for months and even years** [Carpi and Chen 2001]. Therefore ceremonial use of mercury in the home could also expose future occupants and their children.

Concerns regarding personal responsibility for causing a spill or having to clean up a spill may influence the quality and completeness of the information reported. **Spills in private residences may be under reported** because the **residents are unaware of the health hazard** and the need to report spills ... In addition, the published literature is likely biased toward reporting worst-case scenarios, as opposed to **the more typical exposures that do not cause symptoms or attract attention.**

The individuals affected are most likely to be members of minority populations, raising concerns about environmental injustice in these communities. (ATSDR, Children's Exposure to Elemental Mercury: A National Review of Exposure Events - 2009 <http://www.atsdr.cdc.gov/mercury/mercury_report.html#sec1>)

The abovementioned ATSDR report cited Carpi & Chen's **2001** paper, which is worth excerpting here:

Our data indicate that mercury released from household devices can **contaminate indoor residential environments for decades** following the first release of the metal.

At the highest level of indoor Hg⁰ measured in this study, an adult female would be exposed to approximately 5171 ng day⁻¹, and a child would be exposed to between 2059 and 3111 ng day⁻¹.

If high levels of indoor Hg⁰ are common in the general population, **this exposure route may raise significant concerns regarding mercury health effects in young children**. Current health risk assessments of mercury have not considered this pathway of exposure due to the **lack of available data on household Hg⁰ levels**. Further research is essential to determine if indoor, airborne Hg⁰ is a significant source of mercury exposure in the general population. (Carpi & Chen, *Environmental Science & Technology* **2001** - enclosed)

My accusation/complaint against NYCHA, the NYCDOHMH, the U.S. EPA, Region 2, the U.S. Department of Housing and Urban Development, Region 2, and the NYSDOH, is that despite the evidence that I have presented above, have all denied that ritualistic mercury contamination of housing, and specifically NYCHA housing exists, or if it does exist, poses a significant health threat to NYCHA occupants.

Below are some examples of governmental indifference and denial of the environmental health threat posed by prior ritualistic mercury spills in housing, both public and private. This indifference and denial has resulted in governmental failure to assess mercury vapor levels in housing, and hence government's ability to conduct an effective health education and outreach campaign in those Caribbean and Latino communities where elemental mercury is known to have been sold for magico-religious (as well as ethnomedical) applications which have contaminated homes, automobiles, and individuals.

The Department [of Health & Mental Hygiene] has tested for exposure to mercury in the blood and urine of a large, representative sample of thousands of New Yorkers as part of the most recent New York City Health and Nutrition Examination Survey. There have been no identified cases of ritualistic mercury exposure found by this study.

From the earliest reports of possible ritualistic mercury exposure, the Department has made every reasonable effort to determine whether such practices take place, with what prevalence, and whether mercury exposure is occurring.

The Department has also distributed numerous educational brochures on the hazards of mercury in Spanish, English and Creole. There have not been reported cases of elevated mercury exposure due to ritualistic use in New York City. Based on the evidence available to us, **we do not currently believe that additional studies are warranted**. (Farley, Commissioner, NYCDOHMH Letter to Wendroff, **2014** - enclosed)

A serious problem associated with assessment of mercury vapor exposure by using UMLs as the biomarker, is the lack of correlation of the UML with ambient mercury vapor levels when the Hg⁰ level is in the vicinity of the current evacuation level of 10 micrograms per cubic meter (10µg/m³).

although mercury levels in air and urine are correlated below 50 µg/m³, the impact of airborne mercury levels below 10 µg/m³ is likely to be indistinguishable from background urinary mercury levels.

Conclusion A correlation between air and urine mercury does exist at airborne mercury levels < 50µg/m³. However, **the relationship between urinary mercury and airborne concentrations of elemental mercury is only reliable down to concentrations of about 10 µg/m³**. Below 10 µg/m³, predicted urinary mercury levels are within background ranges. **Urinary mercury is therefore not an accurate measure for understanding the exposure of persons due to most environmental air concentrations, which are typically well below 10 µg/m³**. (Tsuji et al, *Environmental Health Perspectives*, **2003** - <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241455/>)

Tsuji et al's caveat applies to all biomarker (UML) studies that are not correlated with mercury vapor levels. What is required, as stipulated in the several citations above from both government agencies, such as the NJDEP, EPA, and ATSDR, is to first measure mercury vapor levels in apartments, and then perform biomarker (UML) studies on occupants of demonstrably Hg⁰ contaminated homes. The methodology used in the two (enclosed) NJDEP studies of **2003** and **2007**, and recommended by in the (enclosed) EPA R2 letter and grant application, is the only one that can definitively assess the levels of contamination of housing, and the environmental health status of occupants of occupied housing.

You were correct to note that **DOHMH removed from its website in December 2005** the fact sheet on elemental mercury. We did so in order to update public materials so that they are in agreement with recent changes to NYS Department of Environmental Conservation (DEC) regulations regarding the sale and disposal of mercury containing consumer products. New York State's Mercury-Added Consumer Products Law (NYS DEC 2004) amended ... **DOHMH materials are being revised and will be reposted to the Web at some time in the near future.** (Kass, Director, Environmental Surveillance and Policy, NYCDOHMH, Letter to Wendroff, **2006** - enclosed)

This material informing health care providers and the lay public was initially published in brochure format in late **1999** and early **2000**. It was initially in printed format, and was allegedly mailed to some 3,000 to 4,000 general practitioners, pediatricians, and obstetrician-gynecologists. These sets of four brochures (one for health care providers, in English, and a set of three for the lay public, in English, Spanish, and Haitian Creole editions). They were also to be widely disseminated in health clinics serving heavily Caribbean and Latino clientele around New York City. The cover letter by Commissioner Neal Cohen stated:

metallic mercury available in botanicas and religious stores is used in religious or ethnomedical practices in a manner that may adversely affect health.

Mercury vapors can persist in indoor environments for long periods of time, and, because the vapors are invisible, people who live in or regularly visit homes where mercury is used may not be aware that they are being exposed. Unfortunately, metallic mercury has the greatest effect on the developing central nervous systems of fetuses and young children. (Cohen, Commissioner, NYCDOH, Cover Letter, January **2000** - enclosed)

So, the then Commissioner of Health stated that ritualistic mercury spills "can persist in indoor environments for long periods of time." Yet more recent DOH Commissioners and environmental health officials have ignored this stated property of mercury spills, and deny that there could be a problem from mercury vapor emanations from 'historic' ritualistic mercury spills.

The professional publication that Commissioner Cohen introduced stated that

The vapor particles will stick to almost anything: jewelry, carpets, draperies, clothing, furniture and cracks in floors. **Metallic mercury vapors are invisible and may persist throughout the room for many months or years.** Because mercury vapors can remain within indoor environments for extended periods of time, **people who live in or regularly visit these households may be at risk for exposure to harmful levels of mercury vapor.** The risk of exposure may be greater during cold seasons, when people heat their homes and close their windows, trapping heat (and mercury vapors) inside. (NYCDOH, [Metallic Mercury Exposure: A Guide for Health Care Providers](http://www.mercuryproject.org/pdf/metallic99.pdf), n.d. ~January, **2000** <<http://www.mercuryproject.org/pdf/metallic99.pdf>>

The DOH had removed this brochure from its web site and over a decade ago, and has refused to replace it, let alone update it. DOH also removed the three lay brochures (in English, Spanish, Haitian Creole) from its web site and again, has refused to replace or revise them. The English edition stated

HOW TO MEASURE THE AMOUNT OF AZOGUE/VIDAJAN IN THE BODY OR HOME

The only way to know if there are *azogue/vidajan* vapors in the home is to test for it with special equipment, such as a **mercury detector (mercury vapor analyzer) that measures the level of azogue/vidajan in the air in the home.** For more information about mercury air testing, call the New York City Department of Health. (NYCDOH,

This suggests that measuring mercury vapor levels is a useful way to ascertain if a home is contaminated and its occupants exposed. Yet in the intervening decade and a half, the DOH has made a volte-face, and now denies that there is any need to assess mercury vapor levels in housing, and NYCHA has used this as an excuse for not performing such an assessment, again, despite the preponderance of scientific opinion to suggesting that this is the most valid way to assess exposure. This is like stating that there is no need to assess lead contamination of housing, as by taking swab samples or x-ray fluorescence measurements.

NYCHA wrote that as

New York State DOH studies indicated that there is neither widespread nor significant exposure from ritualistic mercury use, we do not feel it necessary to conduct a separate NYCHA study. (Ponce, NYCHA, Letter to Wendroff, 2010 - enclosed)

and this denial of the need to assess mercury vapor levels was based on earlier NYSDOH correspondence

Your email also indicates that NYSDOH has not made any efforts to assess the levels of mercury vapor in housing where magico-religious practices involving mercury may occur. **Measuring mercury levels in residential settings may not yield useful information about the source of any detected mercury and limited information on people's actual exposure to the mercury.** (Freed, Director Center for Environmental Health, Letter to Wendroff, NYSDOH 2009 - enclosed)

I have a great deal more documentation of the intentional obfuscation of the DOH, as well as of multiple New York City, New York State, and federal agencies who have refused to act to protect the public from exposure to mercury vapor in their homes. I have kept detailed log books dating from September 1990, detailing my interactions with individuals and agencies (via mail, email, fax, phone, and direct meeting) relating to magico-religious mercury contamination. The current page (8 1/2" x 11" @ ~25 lines per page is 2,117. I currently have 3,937 outgoing emails on this issue stored on my computer hard drive, and even more as hard copies. I have 2,315 incoming emails on the mercury issue stored on my hard drive (and backup drives) and all are printed out as well. I have ~60 from the DOH letters on file, as hard copies and pdf's, as well as ~20 letters to me from the NYSDOH. I have ~50 letters from various branches of the NYC government.

Therefore, I can document the failure of these government agencies to protect the residents of NYCHA as well as private housing, and request that your Office investigate my concerns as assiduously as you are currently investigating the lead exposure issue involving NYCHA and the DOH.

Sincerely yours,

Arnold P. Wendroff, Ph.D.

PS: I suspect that the issue that I am putting before you is a civil issue, but if it deemed a criminal case, please forward it to your criminal office.

Enclosures are listed on a separate page/s

LIST OF ENCLOSURES TO U.S. ATTORNEY, SOUTHERN DISTRICT, NY March 20, 2016

Wendroff, **2014**, Magico-Religious Mercury Use and Environmental Health: The Problem and Suggested Solutions

Wendroff, **1990**, *Nature*

Zayas & Ozuah, **1996**, *American Journal of Public Health*

Wendroff, **2014**, *The Lancet Neurology*

ATSDR, **1999**, Toxicological Profile for Mercury -- excerpts

Clarke, NYCHA, **2002**, Letter to Wendroff

Enck, EPA R2, **2010**, Letter and Research Proposal to Wendroff

Ponce, NYCHA, **2010**, Letter to Wendroff

Stern et al, NJDEP, **2003**, Research Project Summary

Stern et al, NJDEP, **2007**, Research Project Summary

Garetano et al, **2006**, *Environmental Health Perspectives*

Wendroff, **2005**, *Environmental Practice*

Garetano et al, **2008**, *Science of the Total Environment*

Garetano, **2006**, SPH-UMDNJ, Doctoral Thesis Excerpts

Johnson, **1999**, *Population and Environment*

Ozuah et al, **2003**, *Ambulatory Pediatrics*

United Nations Environment Program, **2008**, Excerpts

ATSDR, **2009**, Children's Exposure to Elemental Mercury, Excerpts

Carpi & Chen, **2001**, *Environmental Science & Technology*

Farley, NYCDOHMH, **2014**, Letter to Wendroff

Tsuji et al, **2003**, *Environmental Health Perspectives*

Kass, **2006**, NYCDOHMH, Letter to Wendroff

Cohen, NYCDOH, **2000**, Cover letter to mercury brochures

Freed, NYSDOH, **2009**, Letter to Wendroff

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ATSDR **1999** Toxicological Profile for Mercury
<<http://www.fda.gov/ohrms/dockets/ac/06/briefing/2006-4218b1-19-white-paper-draft-Appendix-G1-08.pdf>>

Rogers et al, *Journal of Urban Health*, **2007** < <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2430136/> >

(UNEP Module 5: Cultural Uses of Mercury **2008** < <http://www.unep.org/chemicalsandwaste/Mercury/ReportsandPublications/AwarenessRaisingPackage/tabid/4022/Default.aspx> >

EPA, Task Force on Ritualistic Uses of Mercury Report, **2002** - <<http://nepis.epa.gov/Adobe/PDF/90100I00.pdf>>

ATSDR, Children's Exposure to Elemental Mercury: A National Review of Exposure Events - 2009
< http://www.atsdr.cdc.gov/mercury/mercury_report.html#sec1 >

Tsuji et al, *Environmental Health Perspectives*, 2003 - <<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1241455/>>

NYCDOH, Metallic Mercury Exposure: A Guide for Health Care Providers, n.d. ~January, 2000
<<http://www.mercurypoisoningproject.org/pdf/metallic99.pdf>>

NYCDOH, n.d. ~January, 2000 Azogue Vidajan Metallic Mercury Poisoning n.d. ~January 2000
<<http://www.mercurypoisoningproject.org/pdf/booklet99.pdf>>

Supplementary Enclosures to U.S. Attorney, Southern District, NY March 20, 2016

Muhlendahl, **1990**, *Lancet*

de Cerreno, et al, NYAS, **2002**, NY/NJ Harbor Mercury Histogram

La Peter & De La Garza, **2004**, *St. Petersburg Times* (cited by Mercer et al)

Gill et al, **2009**, *Journal of Forensic Sciences*

Mercer et al, **2012**, *Pediatric Dermatology* + Wendroff's comments (Describes an index case)

Brannan et al, **2012**, *Pediatric Emergency Care* + Wendroff's comments (Describes an index case)

J_____R_____, **2015**, Emails from my former student who in June 1989, informed me that his mother sprinkled elemental mercury on their floor to keep away *brujo* (witches). He exhibited the classic symptoms of erethism, which appeared to be contributory to his learning disability.

Wendroff, **2015**, Letter to Julian Castro, Secretary of HUD

Glantz, Senior Management Analyst, HUD R2, **2016**, Email to Wendroff

Wendroff, *Curriculum Vitae*

MERCURY POISONING PROJECT

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March 3, 2007

Silverio Vega
Mayor,
Town of West New York
428 60th Street
West New York, NJ 07093

(201) 861-2797 fax

Dear Mayor Vega,

In December 2002 the New Jersey Department of Environmental Protection (NJDEP) issued a report, Cultural Uses of Mercury In New Jersey (www.mercurypoisoningproject.org/pdf/njdep.pdf). A summary of that report was issued in May 2003 (www.state.nj.us/dep/dsr/research/mercury-cultural.pdf). This report, and several similar papers in learned journals as well as a doctoral dissertation have all addressed a similar environmental health concern, namely, that there appears to be widespread mercury contamination of housing in West New York, as well as in neighboring Union City.

The source of this domestic mercury contamination is believed to be mercury sold at one time or another by the many botanicas in West New York and Union City, (and possibly elsewhere, as in Manhattan, etc.), which has been put to a variety of ritualistic uses (folk-magic, Santeria, Espiritismo, etc.) by members of these two heavily Caribbean-Latino communities. This ritualistic or magico-religious mercury use is guided by the generic belief that mercury (*azogue*, *mercurio*) attracts good and repels evil. Although there are many ways in which mercury is used to effect these ends, including placing mercury in a wide variety of un-sealed containers, the single most problematic use of mercury is to sprinkle it on the floors of homes, and in automobiles.

This sprinkling of floors with mercury, typically the equivalent of breaking some dozen clinical thermometers without cleaning them up, is guaranteed to contaminate the home for well over a decade with levels of mercury vapor that are certain to be prejudicial to normal neurodevelopment. This is in many ways similar to the widespread contamination of housing with lead, which results in neurodevelopmental deficits in children reared in these contaminated environments.

The West New York Board of Health has been aware of this situation for some time, as has the West New York Mayor's Office. Yet to date, there appears to have been no substantive action taken to address this latent (but very real) environmental health disaster. It seems to me that your Office has a moral as well as a legal responsibility to address this issue. You must request assistance from the NJDEP as well as from the NJ Department of Health and Senior Services, and they in turn will need to turn to the appropriate federal agencies, particularly the US Environmental Protection Agency, and the Centers for Disease Control.

More information on this issue can be found by typing < **mercury Santeria** > into Google, Yahoo etc. search engines, and by referring to my web site. Your Health Officer, Vincent Rivelli is quite familiar with the issue, as is his counterpart in Union City, Richard Censullo. The best single source of information on the problem is Dr. Gary Garetano of the Hudson Regional Health Commission.



You need to act on this issue in your joint capacities as a Mayor and as a New Jersey Assemblyman. Your colleague John McKeon of the Assembly's environmental committee is well aware of the issue, although he has refrained from addressing it. I suggest that you confer with Mayor Stack and the relevant health authorities to devise a strategy to eliminate the ongoing exposure of pregnant women and children to toxic levels of mercury vapor in their homes, much of it from mercury sprinkled years ago by some prior occupant. As federal funding is certain to be required, I also suggest that you contact Representative Sires for his assistance. I look forward to your response.

Sincerely yours,

cc: Vincent Rivelli, Board of Health, West New York (201) 869-1715 fax
 Brian Stack, Mayor, Union City (201) 348-5728 fax
 John McKeon, N.J Assembly (973) 275-1480 fax
 Albio Sires, U.S. Congress, 13th District, N.J. (201) 617-2809 fax

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* The saying "**the buck stops here**" derives from the slang expression "pass the buck" which means passing the responsibility on to someone else. The latter expression is said to have originated with the game of poker, in which a marker or counter, frequently in frontier days a knife with a buckhorn handle, was used to indicate the person whose turn it was to deal. If the player did not wish to deal he could pass the responsibility by passing the "buck," as the counter came to be called, to the next player. www.trumanlibrary.org/buckstop.htm

Curriculum Vitae

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Education

CUNY Graduate Center Ph.D. (Sociology of Medicine) October 1985

CUNY Graduate Center M.Phil. (Sociology) June 1981

Brooklyn College, CUNY M.Sc.Ed. (Education) February 1971

Brooklyn College, CUNY B.A. (Biology) February 1964

Erasmus Hall High School, Regents Diploma, June 1959

Employment

Visiting Scientist, Chitedze Agricultural Research Station, Ministry of Agriculture, Malawi. April-May 1998, May-June 2002.

Co-Principal Investigator, Woodhull Medical and Mental Health Center, Department of Pediatrics, Mercury Absorption Study. 1999 - 2001. (Pro bono)

Co-Principal Investigator, EPA Environmental Justice / Pollution grant to Medgar Evers College/CUNY. October 1998 - October 2000

Research Associate, Geology Department, Brooklyn College/CUNY, 1997-2002

Consultant, Mercury Poisoning Project, EPA Office of Environmental Justice Grant to Puerto Rican Family Institute, Queens, NY. 1997- 1998 (Pro bono)

Science Teacher (various Brooklyn junior high schools) NYC Board of Education, 1970-1996. Retired.

Adjunct Lecturer, Department of Rehabilitation Medicine (Occupational Therapy) Columbia University, College of Physicians and Surgeons, 1985-1991.

Assistant to the President, CUNY Academy for the Humanities and Sciences, 1980.

Adjunct Lecturer, Sociology Department, Brooklyn College/CUNY, 1975.

Primary School Science Curriculum Developer, Domasi Science Centre, [Malawi](#) (U.S. Peace Corps) July 1967-December 1968.

Secondary School Science Teacher, Livingstonia Secondary School, [Malawi](#) (U.S. Peace Corps) January 1967-June 1967.

Biology Laboratory Assistant, Erasmus Hall High School, Brooklyn, NY 1964-5.

Science Laboratory Technician, Berriman Junior High School, Brooklyn, NY 1963.

Publications

"Undervalued, Overdue: Handcarts And Food Security." Friends of Malawi Newsletter, October, 2017 p.11

"Handcarts for Transporting Water in Sub Sahara Africa -- A Neglected Technology." Comment , on line *PLOS ONE* June 22, 2016. <http://journals.plos.org/plosone/article/comment?id=info%3Adoi%2F10.1371%2Fannotation%2F8742e1b4-204b-4292-993c-0fa5e311bcac>

"Preparedness for Public Health Emergencies Improving." Comment, on line *Medscape Family Medicine*. April 29, 2016. https://www.medscape.com/viewarticle/862471?nlid=104393_2581&src=WNL_mdplsnews_160429_mscpedit_obgy&uac=48881DX&spon=16&impID=1078935&faf=1

"Neurodevelopmental toxicity: still more questions than answers" July 2014 *THE LANCET Neurology* 13:7:646-647 Letter

"Is there really a causal relationship between mercury exposure and autism? Some evidence to the contrary!" Our Health and Environment Blog from the Collaborative on Health and the Environment. October 23, 2013. <https://ourhealthandenvironment.wordpress.com/2013/10/23/is-there-really-a-causal-relationship-between-mercury-exposure-and-autism-some-evidence-to-the-contrary/>

"Comments on ‘Assessment of prenatal mercury exposure in a predominantly Caribbean immigrant community in Brooklyn, NY’" *Journal of Environmental Monitoring* 2012,14, 2815-2816 Letter

"Handcarts: The Most Appropriate Transportation Technology for Transfer to Malawi." *Malawi T² Newsletter* Malawi Transportation Technology Transfer Centre Vol. 1 No. 2 Blantyre, Malawi January 2006

"Magico-Religious Mercury Use in Caribbean and Latino Communities: Pollution, Persistence, and Politics" *Environmental Practice* 7:2: 87-96 June 2005.

"The Malawi cart: An affordable bicycle-wheel wood-frame handcart for agricultural, rural and urban transport applications in Africa." Workshop Report. Vol. II - International Workshop on Modernising Agriculture: Visions and Technologies for Animal Traction and Conservation Agriculture. Jinja, Uganda. 19th - 25th May 2002. U.N. Food and Agriculture Organization, Rome, Pp. 189-197. 2005.

"The AfriCart's Role in Malawi's Agricultural Economy" *Business Voice* Malawi Confederation of Chambers of Commerce and Industry, First Issue July/August 2004 pp. 26-27

"The Toxicology of Mercury." *New England Journal of Medicine* 350:9:945 February 26, 2004 Letter

"Public Health Crisis in the Low-Income Community: Domestic Mercury Poisoning." *Vital Signs* Coalition of Concerned Medical Professionals. New York, 27:1:3,18-19. Winter 2003 [actually late 2002]

"Handcarts in Malawi and Sub-Sahara Africa." *Anthropology News*. Association for Africanist Anthropology. Guest Column. Pp. 38-39 Jan. 2003.

"Healthier Transport Options" *The New York Times*. March 19, 2002. Letter.

"IOM Scrutinizes Link Between Vaccines, Neurological Problems." *Medscape Pediatrics* July 2001 Letter <http://www.medscape.com/Medscape/pediatrics/journal/2001/v03.no4/...mpe0731.wend.htm>

"Domestic Mercury Contamination in Hispanic and Caribbean Communities in New York City." *BCC Science & Technology News*. 2:2:1,4,5. Bronx Community College. May 2001.

"Excerpts and Comments [on EPA's] Mercury Research Strategy in: Report on the Peer Review of EPA's Draft Mercury Research Strategy. Final Report. Appendix G, Written Comments by Observers. pp. 1-25. 2/3/00 Eastern Research Group, Lexington, MA. EPA Contract No. 68-C-98-148.

"Mercury Contamination Risk for Certain Residential Properties." *Environmental Times* pp.1,8,16 Fall 1999 (with D.A. Jetter, MPH)

"**Ritual Poisons**" *The New York Times*. August 2, 1997. Letter.

"**Magico-religious Mercury Exposure.**" *Environmental Health Perspectives*, **105**:3:266. March 1997. Letter.

"**Magico-Religious Mercury Poisoning and Cultural Sensitivity.**" *American Journal of Public Health*, **85**:3:409-410. March 1995. Letter.

"**More on EPA Mercury Warning.**" *The Nation's Health* 25:6:2. July 1994. Letter.

"**Human Powered Garden Carts; Appropriate Farm Transportation.**" in Human and Draught Animal Power in Crop Production. Workshop proceedings, Harare, Zimbabwe. Abridged. 130-31 Food and Agriculture Organization, UN, Rome, 1993.

"**Bodies at Rest: Rousing Officialdom to the Peril of Domestic Mercury Pollution.**" Research poster abstract. *Journal of Health Care for the Poor and Underserved*, **3**:1:256-257. Summer 1992.

"**El envenenamiento con mercurio.**" *Medico Interamericano*, **10**:11:64,66,68. Nov. 1991. (Translation by Dr. H. Carasquillo)

"**Bringing Attention to Mercury Threat.**" *Society for Applied Anthropology Newsletter*, **2**:1:3-5 Feb. 1991.

"**Domestic mercury pollution.**" *Nature*, **347**:6294:623 Oct. 18, 1990. Letter.

Trouble-Shooters and Trouble-Makers: Witchfinding and Traditional Malawian Medicine. Dissertation, CUNY Graduate Center, 1985.

"**Health Care and Social Change: The Case of Northeastern Malawi.**" in Third World Medicine and Social Change. pp.253-267 John H. Morgan ed. University Press of America, Lanham MD 1983.

"**The Role of traditional Divining Healers in Northeastern Malawi.**" Paper, African Studies Association, ASA #81-131, 1981.

Conference Panel, Paper, Poster Sessions, Lectures, etc.

"**Environmental Health Effects of Magico-Religious Mercury Use in Caribbean and Latino Communities, & Social factors precluding its assessment.**" Lecture: Environmental & Occupational Health Sciences Institute, Rutgers University, Piscataway, NJ 03/01/19

"**Magico-Religious Mercury Use in Caribbean & Latin American Communities: Another Inconvenient Truth, & Why Social Scientists Should Investigate It.**" Metropolitan Medical Anthropology Association. CUNY Graduate Center 02/07/18

"**Neurotoxic Sequelae of Magico-Religious Mercury Use in Caribbean and Latino Communities: A Latent Epidemic of Mercury Poisoning?**" Grand Rounds, Institute for Neurosciences, New York Methodist Hospital, 11/24/14

"**Environmental Health Issues Surrounding Magico-Religious and Ethnomedical Mercury Use in Caribbean and Latino Communities**" Grand Rounds: Department of Obstetrics & Gynecology, Brookdale Medical Center, 04/23/14

"**Environmental Health Effects of Magico-Religious Mercury Use in Caribbean and Latino Communities & Factors Impeding its Assessment**" Lecture: Environmental & Occupational Health Sciences Institute, Rutgers University, Piscataway, NJ 01/07/14

"**Magico-Religious Mercury Use Contaminates Latino Homes and Poisons Their Occupants.**" Latino Health: Social Justice & Latino Health, 4th Annual Conference. N.Y.U. School of Medicine Centers for Health Disparities Research. New York, 10/28-29/05.

"**Magico-Religious and Ethnomedical Mercury Use in the Caribbean Communities.**" Caribbean American Medical and Scientific Association. Conference on "Impact of Environment on Health: A Caribbean Perspective." Methodist Hospital, Brooklyn, NY

"**Mercury and Birth Defects: What You Should Know.**" Presentation. Combined Meeting of the Brooklyn Healthy Start Initiative Project and Comprehensive Prenatal Perinatal Services Network. Brookdale Medical Center, Brooklyn, NY 12/3/03.

"Cultural Uses of Mercury—An Update." Panel Session. Eighth Annual Conference On Environmental Issues: Safety from the Environmental Hazards in the Home, School and City. Medgar Evers College/CUNY Brooklyn, NY 3/8/03.

The AfriCart: Conference presentation and handcart and handcart building demonstrations: Workshop on Improving Mobility for Rural Poor: Achieving Sustainable Motorised and Non-Motorised Transport. Organized by the International Forum for Rural Transport and Development. Morogoro, Tanzania. January 20-23 2003.

Pediatric Magico-Religious Mercury Exposure. Poster Session, Children's Environmental Health II: A Global Forum for Action. Children's Environmental Health Network & Canadian Institute of Child Health. Washington DC 9/9/01.

Hearing (held at my request) on the Ritualistic Mercury Problem. Congresswoman Nydia Velazquez. I submitted written and oral testimony. Brooklyn, NY 2/9/01.

New York City Council, Housing & Buildings Committee. Invited to testify and submit a written statement at hearing on Int. 832 to ban the testing of gas piping systems with gauges that use mercury. 11/09/00.

Demonstration of bicycle-wheel handcarts to the President of Malawi, H.E. Dr. Bakili Muluzi at Mzuzu Stadium, during the 125th Anniversary Celebrations of the founding of the Livingstonia Mission. 7/29/00.

Radio Program: "Radio House call," Gerald Deas, MD Moderator, WLIB New York, 119.0 AM. Six five-minute interviews to be aired daily on 3/20-3/24 and 3/27/00 (Taped 3/13/00) [aired 3/14/00]

Environmental Justice Implications of Magico-Religious Mercury Use. Seminar, Ramapo College, NJ 2/23/00

"Dangers of Magico-Religious Mercury Use." Cable television interview, SUNY Health Science Center at Brooklyn. Gerald Deas, M.D., interviewer. 9/15/99.

Lecture/Grand Rounds: **"Reproductive Effects of Magico-Religious Mercury Exposure."** Department of Obstetrics and Gynecology, Woodhull Hospital. [Invited: 5/21/99].

Religious and Mystic Uses of Mercury. Presentation to Southern States Mercury Task Force. Destin FL. 5/6/99

"Magico-Religious Mercury Use in Caribbean & Hispanic Homes." Presentation to , New Jersey D.E.P. Mercury Task Force, Trenton, NJ 4/9/99

"Toxicology and Sociology of Magico-Religious Mercury Exposure in Caribbean and Hispanic Homes." Lecture Woodhull Medical Center, Brooklyn NY 3/11/99.

"Magico-Religious Mercury Use in Caribbean & Hispanic Homes: Why Have Governmental Agencies, Community and Environmental Justice Groups Failed to Address This Issue?" Community-Based Research for Environmental Justice: Conference. The Community/University Consortium for Regional Environmental Justice. Rutgers University, Newark, NJ 2/27-28/99. Poster.

"Neuropsychological Effects of Magico-Religious Mercury Use." Lecture, Brooklyn Psychiatric Centers, Inc. 2/9/99.

"Religious Mercury Use: Implications for Environmental Health" Panel discussion. Third Annual Conference on Environmental Issues. Medgar Evers College. 3/14/98.

"Magico-Religious Mercury Use." Lecture, CUNY Language Immersion Program, Manhattan. 3/2/98.

"Magico-Religious Mercury Use." Lecture, Wolfe Institute, Brooklyn College / CUNY 2/26/98.

Panelist: **"Toxics in Your Homes."** Harlem Environmental Impact Project, Inc. 2/20/98.

Panelist: **"PCB/Mercury Poisoned Fish From the Hudson/East Rivers."** Harlem Environmental Impact Project, Inc. 3/11/98.

"Magico-Religious Mercury Exposures." Lecture to Environmental Toxicology Class, Hunter College / Health Sciences Campus. 3/4/98.

"Toxicology and Sociology of Magico-Religious Exposure to Mercury in Caribbean and Hispanic Homes." Faculty Development Program, Department of Occupational Therapy, SUNY Health Science Center at Brooklyn. 1/29/98.

Lecture to Health & Nutrition Science Club, Health and Nutrition Science Department, Brooklyn College / CUNY on the Mercury Poisoning Project. 12/1/97.

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Research and Development Experience Overseas

Extensive fieldwork in traditional medicine and allied topics in Malawi (19 field trips totaling 33 months) and Nepal (4 months).

Invited by Malawi's Minister of Agriculture to demonstrate feasibility of handcarts for smallholder farmers. Worked with Department of Research and Technical Services to design, fabricate and evaluate handcarts at Chitedze Agricultural Research Station, Lilongwe, Malawi.. April - May 1998; May-June 2002, June-July 2003, June-July 2004. Development and demonstration in Malawi of the "Malawi-Cart," handcart-goat cart-bicycle trailer fabricated from wood and bicycle wheels. The only handcart to be developed in sub-Saharan Africa using locally available materials and capable of being made by local carpenters, at a cost affordable to significant numbers of the population. Trained carpenters to build handcarts. Carts demonstrated to representatives of CARE, World Bank, National Smallholder Farmers' Association of Malawi and Malawi Rural Travel and Transport Programme, FAO, GTZ, etc.. Carts demonstrated in Uganda and Tanzania. AfriCart assessment by Millennium Villages Project/Earth Institute - Columbia University.

Honors & Miscellany

Peer Reviewer, *Environmental Health*, 4/15

EPA Region 2 Environmental Quality Award, April 24, 2003

Peer Reviewer, *Environmental Health Perspectives*, National Institute of Environmental Health Sciences, 9/00, 8/03

One of the "Twenty Brooklyn Heroes." Brooklyn Center for the Urban Environment. 5/7/99.

Member, EPA Ritualistic Uses of Mercury Task Force 1/99-8/01

Sigma Xi, The Scientific Research Society, Associate Member, Brooklyn College Chapter, 1987.

New York State Regents Scholarship, 1959

Grants

U.S. Environmental Protection Agency, Office of Environmental Justice. Mercury Poisoning Project: Exposure in Hispanic Homes (Grant to Puerto Rican Family Institute. Approval Date 7/24/97) Consultant.

U.S. Environmental Protection Agency, Office of Environmental Justice. Preventing Mercury Pollution from Magico-Religious Uses in Brooklyn's Crown Heights and Sunset Park Neighborhoods. (Grant to Medgar Evers College, CUNY.) Co-Principal Investigator.

Current Research, Development and Advocacy Activities

Advisor to the Dedza East Trust [Malawi] 2014 - 2016.

Appropriate Transportation Technology Project: Introducing inexpensive handcarts to African peasant farmers. I am currently sponsoring assessment and dissemination of handcarts for use in Malawi, working with the Agricultural Engineering Department of Bunda College, LUANAR. (1989 - present).

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VITA.APW 10/25/18

Mercury as folk potion sickens users, pollutes

E-mail  Print



CARMINE GALASSO / THE RECORD

▲ Felix Mota, a voodoo priest, says he quit selling azogue, or mercury, in his store, but many continue, unaware of its health risks.

Tuesday, March 16, 2004

By LINDY WASHBURN
STAFF WRITER

The voodoo priest sits in a room lighted by burning candles, where masks and saints, liquor bottles, and a bowl of money are arranged on altars. Azogue is a toxic and dangerous substance, he begins.

He explains its allures: It speeds the magical effects of spells cast for the loveless, the luckless, and the sick, some believe. It is a talisman to the gambler, a protector against the evil eye. Some sprinkle it in rooms, cars - even baby cribs - for protection.

Azogue is quicksilver - mercury.

It is poison.

It is a poison that lowers children's academic performance and increases their behavior problems. In Hudson County, it contaminated the air in one in five apartment buildings surveyed for a recent study. So many people have been exposed to it that health officials have detected it in the sewage flowing into New York Harbor.

Tuesday, March 16, 2004

- [Mercury as folk potion sickens users, pollutes](#)

Monday, March 15, 2004

- [Reservoir's mystery: Extra high mercury](#)

Sunday, March 14, 2004

- [Mercury Q & A](#)
- [Mercury's menace](#)
- [Salvage helps prevent mercury contamination](#)

And it is widely available in the botanicas, or folk pharmacies, of Latino and Caribbean communities in New Jersey, where a tiny glass bottle containing up to 2 teaspoons usually sells for \$3.

The voodoo priest stopped selling it three years ago. But elsewhere, "it sells a lot, I'm telling you," says Felix Mota, the priest and owner of St. Barbara Botanica in Passaic. "I used to order 10 or 12 dozen [vials], and it would be gone in less than two or three months."

Some experts say the widespread use of mercury for folk medicine and ritual among Hispanic and Haitian immigrants could end up costing millions of dollars - for the additional expense of educating affected children and cleaning up hundreds of contaminated apartments. In Passaic City, Hudson County, and New York City, the use of mercury is just beginning to come to the attention of health officials.

"This is not an extremely common event," says Dr. Michael Gochfeld, the principal investigator of the New Jersey study. "But it's not rare enough that we can be complacent."

A 2002 study found that indoor air samples in almost one-fifth of the 67 Hudson County apartment buildings tested had elevated levels of mercury and that nearly all of 22 Hudson County Santeria practitioners and botanica employees used mercury. Priests of Santeria, a religion practiced by some Cubans, and voodoo occasionally use mercury in rituals.

A follow-up study this year will systematically check the air inside apartments and hallways.

The ramifications could be explosive.

Mercury is a potent toxin - long-lasting, readily spread through droplets and evaporation, and easily absorbed through the lungs. If inhaled on the job, it is considered an occupational hazard for which evacuation and hazardous materials cleanup are required.

In adults, mercury exposure can cause personality changes, tremors, and damage to a person's lungs, kidneys, and stomach. In children, mercury vapors easily pass into the brain and nervous system, causing permanent developmental problems. Children may be slow to walk and talk, less intelligent, and more susceptible to autism and attention deficit disorder.

In buildings, contamination can last for a decade, as the mercury slowly evaporates. It is absorbed by porous surfaces: carpets, wood floors, even concrete.

Most exposure in humans occurs through the diet, by consuming fish with high levels of methylmercury, a mercury compound.

Arnold Wendroff, a medical sociologist who founded the Mercury Poisoning Project in Brooklyn, says state, federal, and local officials have failed to act on a problem that leads to millions of dollars in special-education costs and will eventually require the evacuation and cleanup of hundreds of apartments.

MERCURY POLLUTION:

Every lake and stream in New Jersey is tainted with mercury, forcing the state to warn people to limit the amount of fish they eat. Cutting mercury pollution from power plants, the main source of the contamination, has sparked a heated debate in Washington. How fish become tainted:

1. Coal-fired power plants release mercury (Hg) into the air.
2. Mercury can be carried hundreds of miles before falling to earth and settling in the sediment of lakes, rivers, ponds, and oceans.
3. Bacteria in the sediments then convert it to methylmercury, which can be absorbed in the tissue of living things.
4. Plankton ingest the bacteria. Insects and small fish eat the plankton. The mercury increases in concentration as it works its way up the food chain.
5. Large predator fish such as bass, walleye, tuna, and swordfish can have levels of mercury one million times higher than the surrounding water.
6. More than 2 million lakes and 500,000 miles of rivers in the nation are tainted with mercury, and people are told to limit the consumption of certain fish from those waters.
7. Cooking or cleaning fish does not reduce mercury contamination.
8. Children born to mothers who have high mercury levels are slower to walk and talk and can suffer learning disabilities. The federal government estimates that 630,000 babies born every year in the United States may be at risk. In adults, mercury may increase the risk of heart attack and infertility and cause memory and concentration problems.

Sources: National Wildlife Federation, New Jersey Department of Environmental Protection; U.S. Environmental Protection Agency

There is "a strong probability that large populations are exposed to developmentally neurotoxic levels of mercury vapor in their dwellings," he says.

Much of the exposure is to people who have no idea that previous tenants sprinkled or spilled mercury inside, he says.

"Once you throw that mercury on the floor, it's going to stay there for a decade," he says. "The metal is absorbed by porous surfaces, and can only be removed by taking out carpet, wood flooring, and concrete to a thickness of half an inch.

"No one really wants to address this issue," Wendroff says, "given the enormity of the political and economic fallout."

The sale of mercury is legal as long as it is properly labeled as a hazardous substance. Sales in northern New Jersey have been driven underground, researchers say, because botanica owners think it is illegal or fear they will be held responsible for spills or harmful consequences.

Still, mercury is readily available. "People buy it a lot!" Mota says.

Researchers say mercury is used in two ways: as part of an organized religion, such as Santeria, Espiritismo, or voodoo, where priests imbue it with spiritual power in certain rituals, or in cultural or superstitious practices in which people believe it brings good luck.

"People buy it to put in candles - candles for money, for love, to pray for somebody," Mota says. He used to put a drop of mercury in perfume or bath oils, to spread over the body for good luck, but he doesn't anymore.

"I tell people, 'Don't use it. It's so dangerous.'"

One woman Mota treated six or seven years ago had swallowed mercury at the instruction of a santero, a Santeria priest, before she came to the United States.

Mota says he was recently offered a 10-pound jar of mercury, but he didn't want to repackage it himself. As a practicing voodoo priest and initiated santero, he's too busy with private consultations and tarot readings for his patients. Besides, "Where would I do it? Here? At home where my kids are?"

In a 1996 survey by Montefiore Medical Center of 38 botanicas in the Bronx, researchers found that the stores sold a minimum of 25,000 vials a year, nearly half a ton annually in that borough alone.

Urine testing of children who lived in that area found that five of 100 tested had elevated mercury levels - a percentage similar to the occurrence of lead poisoning in the same population. The Centers for Disease Control and Prevention is following up this year with a larger study, of 250 children living in northern Manhattan and Brooklyn.

A study of pollution in New York Harbor by the New York Academy of Sciences estimated that mercury from cultural and religious practices totaled about 400 kilograms, or 880 pounds, a year. That equals the amount produced by coal-fired power plants, which rank nationally as the largest unregulated source of mercury pollution.

Sewage coming from a neighborhood in northeastern Manhattan showed excessive amounts of mercury, according to a new study by the New York City Department of Environmental Protection. Inhaled mercury is usually excreted through urine and feces.

New Jersey's study of botanicas and apartment buildings was initiated at the recommendation of Wendroff, who alerted the state Task Force on Mercury in 2001 about the widespread use of mercury among certain ethnic

groups. Wendroff, a former junior high school science teacher in Brooklyn, remembers the day in 1990 when his interest in the subject began.

"I was teaching a chemistry lesson on mercury, and I asked the kids if they knew what it was used for," he says. "I expected them to say thermometers. One of the kids says, 'My mother uses it in Santeria.'"

The boy explained that she sprinkled it on the floor "to keep away the brujas," or witches. The boy knew the botanica where she bought it, and agreed to bring some to school. Two days later, the boy showed up with a capsule.

Wendroff subsequently realized that the boy showed some signs of mercury poisoning.

Occupational exposure to mercury - among hatters in 19th century London, for example - causes a syndrome called erethism, characterized by anorexia, irritability, short-term memory loss, and dislike of being observed. "This kid had all four of them," Wendroff says. "He would put his head on his desk and invert his loose-leaf notebook over it."

The New Jersey study employed a Santeria priest from New Mexico to interview practitioners in Hudson County. He reported:

- A Colombian santera "lamented the fact that it's now more difficult to sell mercury ... [She] says that mercury made up an important part of her sales in the past. She has sold mercury to other Colombians, Mexicans, Cubans, and North Americans. She keeps it in her house rather than the botanica and prefers to sell larger quantities as opposed to capsules."
- In another shop, owned by a Cuban and Puerto Rican couple, "Mercury capsules are very cheap in this botanica (\$1.50). Their logic is that people won't report them if they get a bargain."
- A Dominican santera "uses elemental mercury and red, yellow, and blue precipitados [mercury oxides] in secret Santeria rituals." She told the researcher that "elemental mercury could be sprinkled for good luck or could be placed in a water goblet [with water and camphor]."

Those interviewed "were unaware of the hazards of mercury," the report says.

They knew it was "bad to touch or play with, [but] no one knew about the dangers of mercury vapors or the possible effects of long term exposure. The only 'hazard' they mentioned was the legal trouble they thought you could get into if you were caught with mercury."

The study also found mercury vapor was "significantly elevated" in 17 percent of the apartment buildings tested, says Alan Stern, a co-author and head of the state Department of Environmental Protection's risk analysis bureau. The study didn't identify a cause. It may be due to cultural use or something as simple as breaking a thermometer, he says.

Other studies have suggested that local laws be enacted to require that dwellings be tested for mercury - and buyers or tenants informed of the results - when they are sold, much as some states require radon or lead testing.

Routine testing of children's mercury levels, as they are currently tested for lead, may be a good idea in some locales, researchers say.

"We want to protect people's health, and that's the bottom line," Stern says. The goal "is to convince people that this is not a smart and healthy thing to do. If we do this in a clumsy way and drive this underground, then we're not going to be helping anybody."

Staff Writers Monsy Alvarado and Alex Nussbaum contributed to this article. E-mail: washburn@northjersey.com.

"Elemental Mercury Poisoning Presenting as Hypertension in a Young Child"

by: E. Brannan, S. Su, & B. Alverson. *Pediatric Emergency Care*, August, 2012

"The uncontrolled use of ceremonial mercury is widespread, not currently being evaluated effectively, and is certainly not well appreciated,"¹ The illustrative case, "Elemental Mercury Poisoning Presenting as Hypertension in a Young Child,"² demonstrates these points, insofar as it overlooked information that clinicians serving and Latino communities need to be aware of. The paper suggests that the source of the mercury contaminating the Puerto Rican patient's home was from ritualistic mercury use by the prior Dominican³ occupant, but makes no mention that this is the first report reasonably associating magico-religious mercury use with mercury poisoning. In other words, this appears to be an index case of elemental mercury poisoning from inhalation exposure to mercury vapor resulting from the ritualistic use of elemental mercury in the home. It illustrates the most common scenario, second-hand exposure to mercury vapor from elemental mercury sprinkled or accidentally dropped on a floor during a ritual performed by a prior occupant, in this case, at least in part at the site of an altar on a bedroom dresser.^{3,4}

When the Dominican woman's subsequent apartment was tested, after her occupancy of some 3 months, markedly elevated mercury vapor levels were found, with the highest level, $5\mu\text{g}/\text{m}^3$, in the same locale as in her prior apartment, namely on the floor by her bedroom dresser, the site of her altar as reported by neighbors, where the mercury vapor level was $34\mu\text{g}/\text{m}^3$.³ The generally recommended evacuation level for mercury vapor in a home is $10\mu\text{g}/\text{m}^3$, with a reoccupancy level of $1\mu\text{g}/\text{m}^3$.⁵ Unfortunately, neither the Dominican woman or her teen age daughter were tested for elevated urine mercury levels (UMLs), until well after the initial case of acrodynia was reported.

The mercury vapor levels in the Puerto Rican family's carpeted apartment would likely have been much higher, had their landlord not employed a contractor to clean the apartment after the Dominican occupants departure. The commercial cleaner employed a powerful truck-mounted vacuum cleaner which would have exhausted most of the mercury in the carpeting to the outside air.⁶ However, enough mercury remained in the carpeting to grossly contaminate the Puerto Rican family's brand new vacuum to a level of $90\mu\text{g}/\text{m}^3$.⁷

In cases of mercury poisoning by vapor inhalation, it is essential that all occupants of the contaminated dwelling are promptly tested for the presence of elevated UMLs, as all are exposed to mercury vapor. When this testing was somewhat belatedly performed, the patient's 8 year old sister, 10 year old brother and 32 year old mother were all found to have highly elevated UMLs, of 73, 38 and $49\mu\text{g}/\text{L}$ respectively. The notifiable UML is $20\mu\text{g}/\text{L}$. The two siblings were chelated with DMSA.^{8,9} The father, who lacked health insurance, was not tested.⁷

It is noteworthy that all family members other than the 3 year old girl were asymptomatic, despite their exposure to high levels of mercury vapor and high UMLs, as were the prior occupants, a mother and her teen-aged daughter, who were presumably exposed to far higher levels of mercury vapor, and of a longer duration. The latter two women were never tested, despite their long residence in two mercury-contaminated dwellings, which would appear to be a lapse on the part of the RIDOH.

There could have been no clinical suspicion that any of them were at risk of intoxication, had not the 3 year old exhibited signs of acrodynia. Their exposure to toxic levels of mercury vapor would have continued were it not for their clinicians astute diagnosis of nowadays rare acrodynia. A somewhat

similar case of mercury poisoning of three siblings, with a 33 month old girl presenting with acrodynia, resulting from exposure to mercury from a broken clinical thermometer, led her physician to suggest that "Cases of chronic mercury poisoning may be missed, even today, and all paediatricians and child psychiatrists should familiarize themselves with the clinical picture."¹⁰

The dermatological aspects of the case described by Brannan et. al. were described in an earlier paper, whose authors also speculated that the source of the mercury was its ritualistic use.¹¹ They stated that "Prompt diagnosis and treatment of this disorder may help prevent long-term neurological sequelae." **Such prevention can only be achieved by promptly testing all members of a mercury-contaminated home, especially pregnant women and children.**

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[NOTE: These comments and corrections have not been published.]

"Acrodynia and Hypertension in a Young Girl Secondary to Elemental Mercury Toxicity Acquired in the Home,"

by J. Mercer, L. Bercovitch and J. Muglia *Pediatric Dermatology*, March, 2012

The report of "Acrodynia and Hypertension in a Young Girl Secondary to Elemental Mercury Toxicity Acquired in the Home,"¹ makes a useful contribution to the dermatological literature, but omits some important clinical implications.

Additionally, although correctly attributing the source of the mercury exposure to vapor emanating from mercury spilled on carpeting by a prior occupant, the report misstates those vapor levels as being as high as 40,000 $\mu\text{g}/\text{m}^3$, when in fact they ranged from 10 - 34 $\mu\text{g}/\text{m}^3$.² Also, the mention of the "normal" mercury vapor level as $<100 \mu\text{g}/\text{m}^3$ is erroneous, as the residential evacuation level for mercury vapor is 10 $\mu\text{g}/\text{m}^3$, and the residential reoccupation level a mere 1 $\mu\text{g}/\text{m}^3$.³ The family was evacuated from their apartment when the elevated vapor levels were discovered.

The authors suggest that clinicians "must have a high index of suspicion to recognize mercury toxicity," but omit mentioning that this suspicion must be directed to *all* occupants of a mercury-contaminated dwelling. In this case, the 3-year-old patient's 8-year-old sister, 10-year-old brother, and 32-year-old mother, all had highly elevated urinary mercury levels (UML), of 73, 38 and 49 $\mu\text{g}/\text{L}$ respectively.⁴ The notifiable UML in many states (RI, NY, NJ) is 20 $\mu\text{g}/\text{L}$, but it can be as low as 3 $\mu\text{g}/\text{L}$ (NM).

Clinicians and public health authorities should note that despite their highly elevated UMLs, the other family members were asymptomatic. Had not the 3-year-old girl exhibited the rare signs of acrodynia, in all likelihood the entire ethnically Puerto Rican family would have remained in their mercury-contaminated dwelling, continuing to inhale developmentally neurotoxic levels of mercury vapor.

The report omits mentioning that their elevated UMLs led to the girl's two siblings being chelated at their primary care medical facility,^{4,5} The father's UML was not assessed, allegedly because he lacked health insurance.

This paper is especially significant, as it presents what is in essence an index case of mercury poisoning resulting from its ritualistic use.^{6,7} In this case, which appears to be a typical scenario, (save for the 3-year-old's acute illness), an entire family was intoxicated via second-hand inhalation exposure to mercury vapor emanating from an earlier mercury spill apparently resulting from likely magico-religious mercury use in a Caribbean/Latino cultural context.

The authors note that the mercury's "source could only be speculated," but mention that "some religions in Afro-Caribbean cultures ... ritually sprinkle elemental mercury about the home..." Circumstantial evidence strongly suggests that the prior Dominican occupant of the contaminated carpeted apartment was the source of the mercury.^{2,6} The official environmental assessment² noted that the prior occupant, a Dominican⁶ (not Columbian as mentioned in the report) woman practiced various rituals on an altar on her bedroom dresser. The only liquid mercury droplets were found in the carpeting by the former site of that dresser, as were the highest mercury vapor levels. When the Dominican woman's subsequent apartment was tested for the presence of mercury vapor, the highest levels ($>5 \mu\text{g}/\text{m}^3$) were again found in front of her dresser/altar.²

Although the state report mentions that "The potential exists for several more homes to be checked for mercury issues," there was no assessment of mercury vapor levels in the apartment occupied by the Dominican woman prior to her moving into the apartment that poisoned the Puerto Rican family. Despite the fact that the Dominican woman and her teen-aged daughter had occupied that grossly contaminated premises for over a year, and although their subsequent apartment was contaminated to half the evacuation level, neither of their UMLs were assessed.

Clinicians serving Caribbean and Latino communities where ritualistic mercury use is likely to be or have been practiced, should be aware of the likelihood of these second-hand ritualistic mercury vapor exposures, as mercury spills can persist for decades at toxic (especially developmentally neurotoxic) levels.^{3,9}

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[NOTE: These comments and corrections were not published!]

Magico-Religious Mercury Use in Caribbean and Latino Communities: Pollution, Persistence, and Politics

Arnold P. Wendroff

Elemental mercury is put to magico-religious uses, most problematically the sprinkling of mercury on floors of homes in Caribbean and Latino communities. Indoor mercury spills are persistent and release toxic levels of mercury vapor over long periods of time. Surveys in these communities have demonstrated widespread and large-scale mercury sales for ritualistic use, elevated mercury vapor levels in public hallways, increased amounts of mercury in wastewater, and elevated urine mercury levels in Latino children. Yet no clear connection has been drawn between ritualistic mercury use and these elevated levels, nor has any pathology been associated with such use. Social, political, and economic factors have acted to preclude advocacy for these affected communities, whose members are largely unaware of their mercury exposure (frequently secondhand) and of its adverse health effects. Without the political mandate to act, environmental agencies have not allocated the resources necessary for environmental professionals to assess and respond to this latent environmental health disaster. Steps to investigate and respond to this impending public health emergency are suggested, as presently there is no coordinated plan for assessing and remediating the tens of thousands of dwellings around the country likely to be contaminated with actionable levels of mercury vapor.

Environmental Practice 7:87–96 (2005)

In 1989, a “learning disabled,” ethnically Puerto Rican ninth-grader in Brooklyn, New York, told his chemistry teacher that his mother sprinkled mercury on the floor of

their apartment to keep away witches. The teacher’s curiosity was aroused; he investigated, found mercury to be widely sold in the community for such uses (Wendroff, 1990), and concluded that his student exhibited symptoms of erethism arising from exposure to mercury vapor. The boy was anorexic, irritable, had short-term memory loss, and exhibited an aversion to being observed, periodically placing his head on his desk and covering it with his inverted loose-leaf notebook (Hartman, 1995). This chance observation was the starting point of much of the research described below.

Nature of the Problem

It has long been recognized that small mercury spills in homes, most commonly from broken thermometers, can produce elevated levels of mercury vapor for long periods of time (Carpi and Chen, 2001; US Environmental Protection Agency, Region 1, 2005). When such spills are reported to public health authorities, assessment and cleanup activities are regularly initiated and contaminated areas are evacuated. Such government concern about mercury toxicity is not in evidence, however, when it comes to other forms of domestic mercury contamination. In some Caribbean and Latino communities, folkloric practices and religious beliefs associated with Santeria, Espiritismo, and Voodoo attribute to mercury the power to attract good and repel evil. In these neighborhoods, elemental mercury is sold for magico-religious and ethnomedical uses by shops called *botánicas* (in the Southwest, *herboristerias* or *yerberias*) in unlabeled vials and fragile gelatin capsules containing an average weight of 10 grams of the metal. The only laws governing such sales appear to be federal and local labeling regulations, regulations that are generally flaunted, as over 90% of mercury sold by *botánicas* bears no labeling at all. Many, perhaps a majority, of ritualistic mercury users are ignorant of either the toxicity of mercury vapor, particularly to the developing brain (Goldman

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and Shannon, 2001), or of the persistent nature of mercury spills (US Environmental Protection Agency, 2002).

Even small, thermometer-sized mercury spills are extremely persistent and can generate problematic levels of mercury vapor for many years. A fever thermometer typically contains 0.7 grams of mercury. One study found residual mercury from a broken thermometer on a tiled bathroom floor continuing to emit substantial levels of mercury vapor after a period in excess of 15 years. The authors concluded that “mercury released from household devices can contaminate indoor residential environments for decades after the first release of this metal, . . . [and] this exposure route may raise significant concerns regarding mercury health effects in young children” (Carpí and Chen, 2001). The actual mercury vapor measured in a recent Agency for Toxic Substances and Disease Registry (ATSDR) investigation of a thermometer mercury spill found that this “small amount of elemental mercury can be readily volatilized by vacuuming and has the potential to pose a long-term human health exposure concern” (Nehls-Lowe and Morrison, 2004). Given the fact that mercury for magico-religious uses is typically sold in 10-gram units, it is reasonable to assume that spills resulting from such use are a great deal more problematic.

Several articles, reports, and conferences have addressed the putative adverse health effects of elemental mercury exposure across its spectrum of ethnomedical and magico-religious uses. The ethnomedical uses include ingestion of mercury to treat abdominal complaints, and intravenous and subcutaneous injection of mercury to boost energy and to protect against infections and evil influences (Celli and Khan, 1976; Geffner and Sandler, 1980; Hryhorczuk, 2004; Prasad, 2004; Trotter, 1985). The magico-religious uses include placing mercury in perfume and candles, mopping the floor with it, and mixing it into bathwater (Greenberg, 1999; Wendroff, 1990). The most environmentally problematic uses, and apparently some of the most common, involve placing mercury in a variety of open or unsealed containers and directly sprinkling mercury on floors and furnishings and inside motor vehicles (Riley et al., 2001). In 1990, the Surgeon General of the Public Health Service wrote: “The ritual of sprinkling mercury on the floor to ward off ‘evil spirits’ is practiced by selected minority groups and may pose potential hazards to those who encounter the mercury” (Novello, 1990). Fifteen years later, these rituals involving mercury are still generally considered a “potential” (versus an actual) health threat, largely because economic and political pressures have operated to retard substantive investigation of the problem.

Scale of Ritualistic Mercury Use

Although, to date, ritualistic mercury spills have not been reported to health authorities, have not been aggressively investigated by these authorities, and have not been described in first-hand case studies in the medical literature, the belief in their occurrence appears to be well founded given the conspicuous place mercury occupies in the beliefs and practices of Hispanic communities. A 1990 survey of 100 Caribbean and Latino women at a public hospital in Brooklyn, New York, found 25% familiar with esoteric uses of mercury (US Environmental Protection Agency, 2002, p. 3). A 1993 survey of ritualistic mercury use in Hartford, Connecticut, and its environs documented substantial botánica sales and use in this largely Puerto Rican community (Hispanic Health Council, 1993; US Environmental Protection Agency, 2002, p. 2). A survey of a largely Dominican community in Massachusetts found that 38% of respondents either used mercury themselves or knew someone who had used it, with 12% of respondents reporting that mercury was sprinkled around a child’s crib or bed (Latowsky, 2003). A similar survey in New York City found that “[f]orty-four percent of the respondents from the Caribbean and 27 percent from Latin America stated that elemental mercury is used in their homes, cars or carried on their person in these cultural practices” (Johnson, 1999). A survey in Chicago found 16 out of 79 Latinos (mainly women) who had used mercury on several occasions (Chicago Department of Public Health, 1997). Given these statistics, it is virtually certain that spills from the ritualistic use of mercury occur with significant frequency, that they result in contaminating dwellings with high levels of mercury vapor (Greenberg, 1999), and that such contamination results in mercury absorption by the occupants of those dwellings “orders of magnitude greater than (methyl) mercury exposures from eating fish or from the leaching of mercury from amalgam fillings” (Wendroff, 1997). The Natural Resources Defense Council has estimated that in the Bronx, New York, ritualistic mercury use “would be likely to cause long-term contamination of more than 13,000 homes or apartment buildings each year” (Quintero-Somaini et al., 2004).

Community Response

The likelihood of contamination of large numbers of Caribbean and Latino homes with substantial amounts of elemental mercury presents a challenge to environmental professionals and a potentially enormous problem for federal agencies (among them the US Agency for Toxic Substances and Disease Registry, the Centers for Disease Control

and Prevention, and the US Environmental Protection Agency) and for state and local health departments. Unlike exposure to methylmercury in fish or to elemental mercury in amalgam dental fillings, exposures to magico-religious mercury spills (1) cannot be limited by changes in diet or dentistry, (2) are likely to entail enormous costs to government for their remediation (Malecki et al., 1995), and (3) have the potential to engender panic among families with pregnant women and small children living in communities where large numbers of dwellings have been contaminated by ritualistic mercury spills (Edelstein, 1988). In contrast to the relative ease of checking dwellings for the presence of lead, radon, and asbestos, assessment of mercury vapor cannot be performed by do-it-yourself lay occupants. Detecting low levels of mercury vapor necessitates inspection by environmental professionals employing sophisticated instrumentation. Unseen mercury droplets lurk in porous flooring, and micro-droplets formed when spills are vacuumed adhere to all interior surfaces.

In typical “toxic disasters,” blame for widespread residential toxic exposures lies with corporate and government polluters. When such deep-pocketed polluters are identified, the wrath of the affected communities is focused on them and remediation and compensation are sought (Edelstein, 1988) and often gained. In one recent case, a corporation responsible for numerous residential mercury spills spent over 140 million dollars in cleanup costs and inspected over 200,000 homes for the presence of mercury (US Agency for Toxic Substances and Disease Registry, 2001; Williamson, 2000). This program resulted in a run on the market for portable mercury vapor analyzers, including 140 instruments leased from one manufacturer (Illinois Attorney General, 2000) and 100 purchased from another (Fenzel, 2005). A class-action lawsuit determined the defendant gas distribution company and its contractors to be liable for negligence, willful and wanton conduct, property damage, and medical expenses resulting from mercury spills from gas distribution equipment in homes (Circuit Court of Cook County, 2001).

By contrast, communities affected by ritualistic mercury contamination of dwellings cannot place the blame on corporate negligence and greed. “Any harm resulting from these practices is not only self-inflicted but also culturally sanctioned. Moreover, no readily apparent epidemic of mercury-related disease has generated the overtly ‘visible victims’ often necessary to bring about aggressive remedial action on the part of already overburdened public health officials. Attempts to call attention to the risks involved have regularly met [with]

indifference and sometimes even outright hostility” on the part of those charged with safeguarding the public health (Foreman, 1998).

Community-based environmental justice organizations have, for the most part, not yet engaged in the issue of ritualistic mercury contamination of dwellings. Despite their acknowledgment that “community members were the only experts who could gather information on such things as angler practices [contributing to methylmercury exposure] and the home remedies used by Latinos . . .” (Corburn, 2002) and their awareness of ritualistic mercury sales by botánicas in their neighborhoods, many have refrained from addressing this issue.

As a result of this indifference, in the 15 years since the health threat posed by ritualistic mercury use has been described in both the medical literature (Greenberg, 1999; Prasad, 2004; Riley et al., 2001; Wendroff, 1990, 1991) and the mass media (Castillo, 2004; Ojito, 1997; Rauch, 1991; Vinicio, 2001), there has been essentially no advocacy on this issue from Caribbean or Latino community organizations, medical professionals, or political representatives. Packard et al. (2004) recently made the statement that “illnesses ‘emerge’ from the suffering of individual patients to become medically recognized problems and public health issues.” As no one appears to be suffering from mercury poisoning, no one is advocating for government to substantively address the issue, aside from a few nominal and inconclusive pilot studies. The relatively straightforward research needed to demonstrate mercury contamination of dwellings and to correlate it with biomarkers of mercury absorption has not been conducted. Government knows what to do, but evidently feels that an actual demonstration of ritualistic mercury contamination, especially with attendant clinical involvement, would open a Pandora’s box that it would rather leave undisturbed.

The following example illustrates governmental ambivalence on this issue. The US Agency for Toxic Substances and Disease Registry (1999) has stated, “There is an urgent need to obtain information on the levels of exposure from these [ritualistic] practices to determine if children or adults are at risk. Mercury vapor concentrations may be much higher after use during the winter months when the heat is turned on and the windows are closed, so data that reflect a variety of exposure scenarios are also needed.” Yet despite this declared “urgent need,” the agency in question has of yet funded no research to meet it.

Real Estate Industry Response

Although the real estate industry has moved to protect tenants from residential toxic exposures, most notably from lead in paint, landlords tend to act only when litigation-driven regulations are enacted (Cahn and Thompson, 2003). Economic constraints make it difficult for landlords, and on occasion for government agencies as well, to apply the Precautionary Principle, which states that if reasonable evidence of toxic exposures exists, then efforts to reduce or eliminate such exposures should be implemented “even in the absence of clear, scientific evidence of harm” (Raffensperger and Tickner, 1999) and that “to wait for scientific certainty (or near certainty) is to court disaster” (Wyman and Stevenson, 2001). In strictly economic terms, then, it is understandable that the applicability of the Precautionary Principle to ritualistic mercury exposure has essentially been ignored by the real estate industry, by government, and by the environmental medical profession, though it is nonetheless deplorable. This is of course hardly the first instance in which, in the collision of economic interest with the Precautionary Principle, the Precautionary Principle has had to give way.

An instance of such a failure to act prior to “scientific certainty” began with an editorial preface to an article on ritualistic mercury contamination of homes, appearing in an environmental publication serving the real estate industry. The editors wrote, “Phase I Environmental Site Inspectors should be sure to notify their lender clients about the risk of mercury contamination in certain residential neighborhoods. Frequently, lenders are unaware of the variety of risks endangering the value of their residential real estate owned. The following is just one of the many ways lenders’ collateral can be jeopardized” (Wendroff and Jetter, 1999). Yet despite such editorial admonition and the wealth of circumstantial evidence of serious and widespread ritualistic mercury contamination presented in the article itself and in several subsequent studies (Garetano, 2004; Latowsky, 2003), to date there has been no apparent interest on the part of the real estate industry, or the environmental assessment profession serving it, in assessing and addressing the widespread contamination of homes with ritualistic mercury.

It seems likely that when the extent and impact of this environmental health threat are ultimately demonstrated, testing of housing stock for mercury vapor at the time of transfer will be mandated, as is currently the case with lead, radon, and asbestos. The political constraints retarding the implementation of such a program will no doubt

be very great. The New York City Housing Authority (NYCHA), possibly somewhat more of an advocate for tenant protection than the private housing sector, has failed to assess its own heavily Caribbean and Latino housing developments and has declined an offer from outside to provide free surveillance of mercury vapor levels in public housing hallways, this despite its own assurance that “NYCHA is giving serious consideration to the mercury issue” (Clarke, 2002). This same communication stated that the New York City Department of Health recommended that NYCHA await the results of an investigation by the New Jersey Department of Environmental Protection. When that study demonstrated that there were elevated mercury vapor levels in Latino housing (Stern et al., 2003), NYCHA still did not assess its own buildings for elevated levels of mercury vapor. The US Department of Housing and Urban Development (HUD) has displayed the same apparent indifference to addressing this issue. A HUD official wrote to acknowledge “a potential environmental health threat caused by contamination of homes, including HUD properties, through ritualistic uses of mercury,” and went on to state that HUD was awaiting results of studies from the Centers for Disease Control and the US Environmental Protection Agency (USEPA) before being able to “justify in-depth environmental assessments” (Teninga, 2002).

Government Agency Response

The Agency for Toxic Substances and Disease Registry’s chronic minimal risk level for domestic mercury vapor exposure is $0.2 \mu\text{g}/\text{m}^3$, and USEPA’s domestic mercury vapor evacuation was recently lowered to $1 \mu\text{g}/\text{m}^3$ by joint ATSDR, USEPA, and Washington, DC, Department of Health consultation over a mercury spill incident so as to be more protective in cases of fetal exposure (Blum and Fernandez, 2003; US Agency for Toxic Substances and Disease Registry, 2003). Government has no direct mandate to lower the body mercury burden of individuals with clinically elevated mercury levels resulting from fish consumption or amalgam dental fillings; however, when mercury contamination of a dwelling is suspected, government has often assumed responsibility for assessment and frequently for decontamination (Baker et al., 2005; Malecki et al., 1995). The same will likely be the case in ritualistic mercury spills, when it generally will be impossible to determine who is legally responsible for the spills and when occupants and frequently landlords will be unable to pay the cleanup costs. As experience with the assessment and cleanup of ritualistic mercury spills mounts, growing familiarity with the pattern and intensity of mercury distribution will make

the identification of ritualistic mercury contamination more assured.

Mounting evidence suggests that large numbers of homes in Caribbean and Latino communities are contaminated with actionable levels of mercury vapor. Much of this mercury contamination was likely caused by prior mercury-using occupants. This residential contamination is believed to result in significant second hand exposure (Greenberg, 1999; Johnson, 1999). Occupational exposures are likely to occur in shops that sell mercury. The New York City Department of Health inspected 20-odd botánicas, many of them known to have sold the metal. Several had elevated mercury vapor levels, and one had from 13 to 17 $\mu\text{g}/\text{m}^3$ in the store itself and from 4 to 7 $\mu\text{g}/\text{m}^3$ in stairwells and hallways leading to the three floors of apartments above (New York City Department of Health and Mental Hygiene, 2000). The New Jersey Department of Environmental Protection found substantially elevated indoor air mercury vapor levels in public vestibules and hallways of heavily Hispanic multifamily housing. It reported that although “most indoor samples were low . . . about 17% of buildings had average air levels above 20 ng/m^3 , with one building average at 299 and a maximum internal reading of 2000 ng/m^3 [2.0 $\mu\text{g}/\text{m}^3$, or twice the recommended evacuation level]” (Stern et al., 2003). A recent survey found that of four apartments actually entered, the mercury levels inside were on an average 5.5 times (ranging from 3.8 to 8.8 times) higher than those detected at the doorjamb in the hallway (Puchalik, 2005). One investigator stated, “The cultural use of mercury has been identified as a potential source of mercury vapor exposure in [these] New Jersey residential settings. In this instance, elemental mercury may be intentionally dispersed within a residence. . . . We conclude that indoor mercury vapor concentrations are substantially elevated over outdoor concentration in many instances. The concentrations in some buildings approach levels of public health concern” (Garetano, 2004).

In late 2001, the US Environmental Protection Agency began a simulation to measure mercury vapor levels from ritualistic spills in a home. Mercury was sprinkled on carpeting inside a house trailer and vapor levels were monitored. A final report has yet to be released, owing to the fact that external reviewers found flaws in the simulation design, which tested only a single type of flooring and simulated neither the effects of walking on it nor of vacuuming it. More problematic still was the incongruity of the experimental results with real-world experience of domestic mercury spills requiring lengthy decontamination to reduce

mercury vapor to a reoccupation level below 1 $\mu\text{g}/\text{m}^3$. The authors concluded, “Intentional ritual sprinkling of metallic mercury. . . may initially produce indoor air mercury vapor levels above the ATSDR suggested residential occupancy level, and in some cases, above the action level, but the concentration decreases over time and generally falls below the residential occupancy level” (Singhvi et al., 2004). The authors go on to state that “ATSDR has proposed a residential occupancy level of 1.0 microgram per cubic meter of air (1 $\mu\text{g}/\text{m}^3$) as the mercury level considered ‘safe and acceptable’ for occupancy of any structure after a spill, provided that no mercury is present” (US Agency for Toxic Substances and Disease Registry, 2001).

Contrast these simulation findings with the actual case of a thermometer containing approximately 0.7 grams of mercury that was broken on the dresser and hardwood floor of a bedroom occupied by a pregnant woman. The occupants cleaned up the visible droplets and then vacuumed the floor. Five days later, mercury vapor levels in the bedroom were over 14 $\mu\text{g}/\text{m}^3$, and the occupants were advised to evacuate the bedroom and ventilate it. Seven days after the initial spill, the bedroom had levels of 2 to 3 $\mu\text{g}/\text{m}^3$, or twice the current recommended evacuation level (Nehls-Lowe and Morrison, 2004). This scenario, involving a minute amount of mercury—probably well under 0.5 gram—should be compared with the situation in which the average 10-gram quantity of ritualistic mercury is spilled in the home, no attempt is made promptly to clean it up, it is tracked about to other rooms and to adjacent hallways and apartments, and in many cases the floors are routinely vacuumed.

Data on botánica mercury sales in the heavily Hispanic Bronx, New York, indicated a range of 25,000 to 155,000 9-gram mean-weight-units of mercury sold in one year (1995), with some 30% of those units likely to be sprinkled on floors (Zayas and Ozuah, 1996). The enormous sales and ritualistic use of elemental mercury in New York City and its environs, estimated at between 500 and 3,000 pounds per year in the Bronx alone (Baard, 2001; Zayas and Ozuah, 1996), has a significant but little appreciated environmental impact. Ritualistic mercury is placed in bathwater and in water for mopping floors, and unused mercury is dumped down drains (Johnson, 1999). Ingested and inhaled mercury is also excreted in feces and urine and, along with discarded mercury, may substantially add to the mercury burden of wastewater (New York City Department of Environmental Protection, 2004). These uses and excretory and disposal pathways allow mercury to enter the aquatic

environment. In the New York/New Jersey harbor, the median source of mercury influx has been found to be divided equally between emissions from electric power plants and emissions resulting from the religious and cultural uses of mercury, each estimated at from 200 to 600 kilograms per year (de Cerreno, Panero, and Boehme, 2002). Several analyses for metals influent to New York City's wastewater treatment plants have found excesses of mercury apparently associated with ritualistic mercury use. The New York City Department of Environmental Protection therefore sampled a small, overwhelmingly Dominican residential area and found major excesses of mercury, 10 to 100 times above the norm (albeit associated with copper, lead, and zinc). The source of this mercury seems likely to be from the contamination of drain traps when ritualistic mercury is disposed (New York City Department of Environmental Protection, 2004).

Biomarker Studies

A pilot study of pediatric urine mercury levels of Hispanic children in the Bronx found 5% with what were deemed to be clinically elevated levels of 5 to 11 $\mu\text{g}/\text{L}$ (Ozuah et al., 2003). A recent Centers for Disease Control/New York City Department of Health study of urine mercury levels of over 400 Caribbean and Latino children in New York City found one with a notifiable level of 24 $\mu\text{g}/\text{L}$ (Jeffery, 2004). The notifiable urine mercury level in New York State is 20 $\mu\text{g}/\text{L}$. Another mercury biomarker study is under way in New York City as part of a citywide health and nutrition examination survey. A study in Chicago found none of the 400 Latino children tested had elevated urine mercury levels (Rogers, Caldwell, and McCullough, 2004). Both blood and urine mercury levels are being measured in a representative sample of 2,000 adults in New York City, the urine mercury levels being measured because of concern over ritualistic mercury exposure (New York City Department of Health and Mental Hygiene, 2004). Unfortunately, these several urine mercury level investigations were designed without reference to recent findings that urine mercury levels resulting from exposure to low levels of mercury vapor, i.e., "below 10 $\mu\text{g}/\text{m}^3$ " are "likely to be indistinguishable from background urinary mercury levels" (Tsuji et al., 2003), so their conclusions are essentially invalid. Scientists from the Centers for Disease Control and Prevention and the New York City Department of Health and Mental Hygiene have stated that their results have been released in a public forum, although no manuscripts have been published as yet (Jeffery, 2005; Rubin, 2005).

Discussion

Fear of the prospect of having to evacuate and decontaminate many thousands of homes in Caribbean and Latino communities around the country has undoubtedly acted to retard substantive environmental and clinical assessment of the ritualistic mercury problem. At the August 2004 conference of the International Society for Environmental Epidemiology, the oral session on "Urban/Ritualistic Mercury Exposure: Assessment to Intervention" demonstrated government ambivalence toward addressing the problem by its failure to mention any substantive governmental "assessment" or "intervention." The tenor of the session illustrated the issues addressed by J. H. Perkins's editorial, "Mercury: Persistence, Pollution, and Politics," which examined economic and political pressures faced by environmental scientists attempting to assess and minimize mercury emissions from coal-fired power plants (Perkins, 2004). Although smokestack emissions far exceed ritualistic mercury releases, they pose only an indirect threat to human health via bioaccumulation in the aquatic food chain, whereas if elemental mercury is sprinkled on the floors of a home, "the apartment or dwelling certainly will become contaminated with mercury [and] subsequent inhabitants will never know they are facing the potential for continuing, potentially serious exposure to mercury" (Greenberg, 1999).

The failure of government to act on this issue is traceable in part to racial, ethnic, and religious factors inherent in ritualistic mercury use and to the absence of community advocacy. Embarrassment over the self-inflicted nature of the mercury contamination accounts in some measure for such absence. This combination of fear, embarrassment, and lack of community advocacy is well illustrated in Paul's article, "Mercury Rising" (2003), which additionally shows how anthropologists, environmental scientists, and physicians have allowed political pressures to influence their professional judgment. One anthropologist interviewed suggests that because remediation of mercury-contaminated dwellings is expensive, will lead to evacuations, and so will anger both the evacuated tenants and their landlords, "you have eventually solved nothing"; further, it intimates that the status quo of domestic mercury exposure be allowed to continue. A physician quoted as stating, "We may be dealing with tons of mercury going into the air, and here we are talking about ounces going into the environment through ritualistic use," ignores the fact that a small amount of mercury in a dwelling can result in dangerously high vapor concentrations. The same erroneous correlation of gross environmental pollution with individual health threat is to

be seen in the suggestion by an environmental health advocate that “a focus on ritualistic [mercury] use is a diversion from much larger sources of contamination . . . [such as from] coal-burning power plants and medical incinerators” (Paul, 2003).

A good example of how academics and medical professionals have elided and glossed over this issue can be seen in a major edited work on Latino health. Although the editors (Aguirre-Molina, Molina, and Zambrana, 2001) and chapter authors (e.g., Zambrana and Flores, 2001) were well aware of the magico-religious uses of mercury and had been provided with extensive documentation on the subject, their section on environmental health entirely omitted mention of the contamination of dwellings from ritualistic mercury use. Their sole reference to mercury exposure in the Latino community was that “[s]hops called *botánicas* . . . sell metallic mercury (*azogue*) as an ethno medical remedy” (Wendroff, 1990), this despite the facts that the reference they cited (1) bore the title “Domestic Mercury Pollution,” (2) made no mention whatsoever of mercury as an “ethno-medical remedy,” (3) repeatedly emphasized the hazards of maternal-fetal and pediatric mercury vapor exposure, and (4) ended with a suggestion that clinical, environmental, and sociological research into these exposures was “required to develop an effective health-education programme for *botánica* owners and their clients” (Wendroff, 1990).

The president of the Latin American Foundation for Environmental Protection in Miramar, Florida, stated that he “tried to reach the politicians to get a better grant for research, [as] its [ritual mercury contamination] a very serious issue. The reason I believe politicians don’t want to do anything about it is because the religious beliefs are too strong for politicians to get involved. My personal opinion is that they don’t want to touch that issue” (LaPeter and De La Garza, 2004). A spokeswoman for the Miami-Dade County Health Department echoed these sentiments: “We can talk about the health issues of mercury in general. . . . But when it’s something related to religion in rituals, it’s not something we deal with” (Fleshler, 2004). In 1993, 31 of 78 *botánicas* surveyed in Puerto Rico were found to be selling mercury (Nunez-Molina, 1993). The USEPA Region 2 and the Puerto Rican Ministry of Health have repeatedly been requested to investigate the environmental health impact of ritualistic mercury use in Puerto Rico, but they have failed to do so. A government-sponsored study in French Guiana found high hair mercury levels in ethnically Haitian women and children, “likely resulting from the use of mercury for religious rituals” (Cordier et al.,

1998), but no follow-up research was conducted to prove or disprove this hypothesis.

A further example of governmental ambivalence on this issue is the statement by the US Agency for Toxic Substances and Disease Registry (cited earlier) proclaiming “an urgent need” to determine levels of adult and child exposure to ritualistic mercury and recognizing that research on “a variety of exposure scenarios” is needed. Yet despite the proclaimed urgency of need, to date there has been no serious government-sponsored research to measure air mercury vapor levels inside living quarters in communities likely to be contaminated by ritualistic mercury use. At the recent USEPA-sponsored symposium, “Mercury: Medical and Public Health Issues,” a senior ATSDR science advisor only briefly discussed “ethnic and folk uses of mercury” (Risher and Amler, 2004). Over the past 15 years, many government environmental health professionals have privately expressed their reservations about government’s ability to substantively address this racially divisive, politically and fiscally explosive issue until there is significant demand for such intervention from the Caribbean and Latino communities themselves.

Recommendations

Sooner or later, government agencies and the environmental profession will have to respond forcefully to this looming environmental health disaster. At present, their denial that there is a serious problem has resulted in a lack of both conceptual and logistical infrastructure to deal with the need to assess very large numbers of homes for mercury contamination and even larger numbers of individuals for mercury exposure and absorption.

For the problem of ritualistic mercury contamination to be taken seriously by both the public health and the environmental health communities, *botánica* mercury sales must be correlated with domestic mercury contamination, with elevated body-mercury burden, and, ultimately, with pathology. There should be little technical difficulty in carrying out such research, but it is clear that without advocacy on the part of the affected communities, government will not allocate resources to gather the necessary data. Therefore, advocacy is the first requirement for conducting the necessary research. Advocacy will, in turn, come about only when the members of the Caribbean and Latino communities, especially community leaders, are, by a program of education, made fully aware of the health threat posed

to their infants, their children, and themselves by the use of ritualistic mercury in their homes.

To date, the standard biomarker of elemental mercury exposure has been the urine mercury level (Goldman and Shannon, 2001). As already noted, however, the validity of this measure for the low levels of mercury vapor likely to be the norm in contaminated dwellings ($<10 \mu\text{g}/\text{m}^3$) has recently been called into doubt (Tsuji et al., 2003). One possible response to this is to separate screening for mercury exposure from screening for mercury absorption. Total mercury levels in unwashed hair include mercury absorbed into the blood and incorporated into the hair structure and adsorbed mercury on the surface of the hair, which is indicative of ambient mercury exposure. Automated instrumentation, requiring no wet chemistry, can analyze hair samples for mercury content accurately, rapidly, and economically (Cizdziel, Hinnners, and Heithmar, 2002). Individuals with elevated hair mercury levels would then be further examined for signs and symptoms of mercury absorption and their dwellings screened for elevated levels of mercury vapor.

It is likely that a convincing demonstration that ritualistic mercury use has contaminated large numbers of homes will precipitate a demand for assessment and remediation that can only be met by government action. Accurate real-time assessment of mercury vapor levels below the $1 \mu\text{g}/\text{m}^3$ range will require large numbers of portable atomic absorption spectrometers (Garetano, 2004). Large numbers of such instruments will be needed in a mercury emergency, along with trained operators (Illinois Attorney General, 2000). Their lack is certain to be a major constraint in both assessment and remediation efforts. Public health and environmental health agencies should be acquiring them now.

When, under a functioning government program of assessment and remediation, dwellings are found to be contaminated with mercury vapor levels above $1 \mu\text{g}/\text{m}^3$, until remediation can be initiated it should be possible to postpone evacuation of occupants by the provision of some form of mercury-vapor filtration system. At least one manufacturer has developed such a filter for domestic use, which it claims is able to “remove mercury vapor from a 10ft² room, with carpeting in approximately 4 hours” (Siperstein, 2004). Such filters need to be further developed, tested, certified, and stockpiled. Their availability would greatly reduce the need for the evacuation of large numbers of dwellings, which in any event would likely prove impracticable, given the numbers of people involved and

the difficulty bound to be encountered in finding alternative accommodations for them.

The unhappy public health consequences of past violations of the Precautionary Principle should alone be sufficient to induce government to delay no longer in confronting the substantial threat to health posed by the ritualistic use of mercury in the home. Common prudence requires that, in concert with the public health and the environmental health communities, it act now.

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Neurodevelopmental toxicity: still more questions than answers

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In their Review, Grandjean and Landrigan expressed concern about the neurodevelopmental toxicity of methylmercury,¹ but did not assess the dangers of serious and widespread inhalation exposures to elemental mercury vapour (Hg⁰) from its magico-religious uses in some Caribbean and Latino communities and the presumptive associated latent epidemic of developmental neurotoxicity this constitutes.

In the belief that it attracts good and repels evil, practitioners of folk magic and Caribbean religions including Espiritismo, Santería, and Voodoo, sprinkle mercury on floors and furnishings where it accumulates levels of mercury vapour, ~~about 80% of which is inhaled or absorbed.~~ **[about 80% of which inhaled is absorbed.]** The Hg⁺ ion is the toxic moiety in methylmercury. Mercury vapour, like methylmercury, is lipophilic and readily crosses the placental and blood–brain barriers and enters breast milk.

The mean weight of mercury sold by botanicas for ritualistic use is about 10 g. Mercury spilt during ritualistic ceremonies that permeates flooring and furnishings can persist for decades, during which time it continually produces mercury vapour. Hence, most exposures are probably second-hand, from ritualistic spills by previous occupants of an individual's dwelling.^{2, 3} Unlike methylmercury ingested in seafood, occupants of such contaminated dwellings cannot control their inhalation exposure and will be unaware of the neurotoxicity of residual mercury in flooring.

Mercury sales in The Bronx in New York (USA), where many people of Caribbean origin live, suggest that in 1995 alone,⁴ between 25 500 and 155 000 homes might have been contaminated with mercury and data from similar Caribbean communities in New Jersey showed that at least 2% of apartments had mercury vapour consistent with its cultural use.⁵

Environmental health scientists, long aware of the hazards posed by ritualistic mercury use and its probable neurodevelopmental sequelae, have not put into action the “precautionary approach that emphasizes prevention and does not require absolute proof of toxicity” advocated for by the authors.¹ Despite Grandjean's previous observation that in “some ethnic groups, metallic mercury is used for magical purposes that may cause substantial exposure to mercury vapor”,⁶ these exposures and their neurodevelopmental ~~affects~~ **[effects]** are not routinely assessed.

That ritualistic mercury exposure contributes to the “silent pandemic of neurodevelopmental toxicity”¹ is suggested by a case of acute magico-religious mercury poisoning in a 3-year-old Puerto Rican girl, apparently due to ritualistic mercury spills by the previous Dominican occupants of the apartment in which she lived.^{2, 3}

Despite more than two decades of awareness of these ritualistic practices and a variety of research on ritualistic mercury sales, use, and reported environmental and clinical mercury levels, the authors' observation that recognition of widespread subclinical toxicity often did not occur until decades after the initial evidence of neurotoxicity is exemplified by the failure of government agencies and the environmental medical community to substantively assess these exposures.

I declare no competing interests.

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Neurodevelopmental toxicity: still more questions than answers – Authors' response

Original Text

[Philippe Grandjean](#) [a](#) [b](#) , [Philip J Landrigan](#) [c](#)

We are grateful for the comments on our review.[1](#) Our aim was to present a balanced assessment based on our best professional judgement concerning toxicity of industrial chemicals to the developing human brain. The diversity of opinion expressed in these letters reflects the serious absence of neurotoxicity information about most chemicals, but we interpret all four letters as supportive of a call for intensified research.

Goldstein and Saltmiras echo Monsanto's oft-repeated defence that glyphosate is a safe herbicide. Still, the toxicity documentation publicly available on this widely used substance is limited. We have been unable to find documentation of any neurotoxicity testing of glyphosate considered valid by the US Environment Protection Agency. Experimental evidence lends support to the likelihood of neurotoxicity.[2](#) On the basis of clinical reports mentioned by Goldstein and Saltmiras, we therefore believe that glyphosate should be considered a neurotoxic hazard. Monsanto's argument for safety relies on the relative absence of research results rather than on data documenting safety.

We agree with Feldman that fluoride is important for children's oral health. However, the fact that a trace element has beneficial effects at low doses in specific tissues does not negate the possibility that neurotoxicity might also be occurring, especially at increased levels of exposure. Indeed, concerns about fluoride toxicity were already raised by a National Research Council expert committee.³ Feldman describes the recent meta-analysis⁴ as selective and based on old, confounder-ridden studies. In support of her claims, she refers to two previous reports that reviewed some of the same studies, although without access to important background information. Feldman makes other serious errors—eg, by linking, without justification, a rise in population mean intelligent quotient (IQ) to the introduction of water fluoridation.

Similarly, Gelinas and Allukian dispute the validity of previous studies on fluoride exposure and neurobehavioural deficits. We do not deny the importance of a dose-response relation, which has been a unifying concept in toxicology since the time of Paracelsus. However, as we emphasised in our Review, emerging evidence on developmental neurotoxicity makes it clear that the timing of exposure is also of great importance, especially during highly vulnerable windows of brain development. Due to the growing evidence on adverse effects, US authorities now recommend that fluoridation of community water should not exceed 0.7 mg/L.⁵

We agree with Wendroff's perspective, but have been unable to identify epidemiological support for a claim of developmental neurotoxicity from exposure to mercury vapour. As elemental mercury might soon be added to the list of confirmed developmental neurotoxicants, we support the evidence-informed prevention of mercury exposures suggested by Wendroff.

In writing our Review, we have tried to steer a middle course between advocates for particular public-health actions and spokespersons for the chemical industry. We believe that sufficient evidence is already available that industrial chemicals endanger human brain development and that unrestrained production and release of such chemicals are short-sighted, dangerous, unsustainable, and fundamentally immoral. We call for a thorough revision of chemical safety policies and for the establishment of a documentation centre on developmental neurotoxicity modelled after the International Agency for Research on Cancer.

We declare no competing interests.

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A LATENT EPIDEMIC OF NEURODEVELOPMENTAL DEFICITS DUE TO EXPOSURE TO MERCURY PUT TO MAGICO-RELIGIOUS USE IN CARIBBEAN & LATINO COMMUNITIES

Initial Draft: letter to editor -- *The Lancet Neurology* -- in press for July 2014

Clinicians concerned about neurodevelopmental toxicity of methylmercury,¹ have neglected to assess serious and widespread inhalation exposures to elemental mercury vapor (Hg⁰) emanating from its magico-religious uses in some Caribbean and Latino communities, and its presumptive associated latent epidemic of developmental neurotoxicity. The Hg⁺ ion is the toxic moiety in methylmercury. Mercury vapor, like methylmercury, is lipophilic, readily crossing placental and blood-brain 'barriers', and entering breast milk.

In the belief that it attracts good and repels evil, practitioners of folk magic, Caribbean religions including Espiritismo, Santeria and Voodoo,^a sprinkle mercury on floors and furnishings, where it evolves developmentally neurotoxic levels of mercury vapor, ~80% of which inhaled is absorbed.

The mean weight of mercury sold by botanicas for ritualistic use is ~10g.^{a,b} Ritualistic spills permeate flooring and furnishings, persisting for decades, while continually evolving mercury vapor.^c Hence, most exposures are likely at second-hand, from ritualistic spills by prior occupants.^{2,3,d} Unlike methylmercury ingested in seafood, occupants of ritualistically-contaminated dwellings cannot control their inhalation exposure, are unaware of residual mercury in flooring, and of the existence and neurotoxicity of mercury vapor.

Mercury sales in the heavily Caribbean Bronx, New York, suggest that in 1995 alone, 2% to 12% of homes were ritualistically contaminated,^e and data from similar Caribbean communities in New Jersey, found at least 2% of apartments with the presence of mercury vapor consistent with its cultural use.^{f,g,h}

Environmental health scientists, long aware of hazards posed by ritualistic mercury use,^a and likely neurodevelopmental sequelae, have failed to operationalize the "precautionary approach that emphasizes prevention and does not require absolute proof of toxicity."¹ Despite Grandjean's observation that "In ... some ethnic groups, metallic mercury is used for magical purposes that may cause substantial exposure to mercury vapor,"⁴ these exposures and their neurodevelopmental impact have yet to be assessed. They have been no measurements of mercury vapor levels in occupied dwellings, and of their correlation with biomarker mercury levels and neurodevelopmental sequelae of exposed occupants.

That ritualistic mercury exposure contributes to the "silent pandemic of neurodevelopmental toxicity"¹ is suggested by a case of acute magico-religious mercury poisoning of a three year-old Puerto Rican girl, apparently due to ritualistic mercury spills by the prior Dominican occupant of her apartment.^{2,3} Although neither paper mentioned it, her eight and ten year-old siblings and 32 year-old mother had highly elevated urine mercury levels of 73, 38 and 49µg/L respectively, yet were asymptomatic, albeit with no neurological assessment.⁵

Despite over two decades of awareness of these practices, and a variety of published research on ritualistic mercury sales, use, and associated environmental and clinical mercury levels,ⁱ the authors' observation that "recognition of widespread subclinical toxicity often did not occur until decades after the initial evidence of neurotoxicity," is exemplified by the failure of government agencies and the environmental medical community to substantively assess these exposures, due to a variety of political and economic, as opposed to medical, rationales.^j

Documentation of the environmental health threat posed by magico-religious mercury use is accessible using the key words < **mercury Santeria** >.

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Is Religion Wrecking Our Air?

By [Jay Wexler](#) [Books](#), [Culture](#), [Science](#) April 4, 2016

What more important natural resource could there be than the air we breathe every minute of every day? And yet, air pollution remains rampant throughout the world. The World Health Organization has estimated that air pollution causes seven million deaths per year from problems such as heart disease, respiratory ailments, and cancer. Major sources of air pollution include mobile sources like cars and trucks and stationary sources like factories and power plants. Relatively minor sources range from cigarettes and hairspray to volcanoes and cow farts.

When it comes to our air, the biggest hazard posed by religion is that religious people really like burning stuff. Whether they are burning incense or firecrackers or logs or paper or pieces of cardboard put together to resemble a small house, religious believers around the globe can't seem to get enough of using fire to celebrate their traditions.

Consider Lag B'Omer. This is a relatively minor Jewish holiday that young people celebrate all over Israel by lighting enormous bonfires to commemorate the death of a famous rabbi and the end of a plague that was killing a different rabbi's students. Even though I was raised Jewish, I had never heard of the holiday until my colleague Jack Beermann told me about it. Jack, who was nice enough to hire me when he chaired the Appointments Committee at my law school fourteen years ago, despite the fact that I misspelled his name in my cover letter, visits Israel often. "When I was there on Lag B'Omer, the whole country smelled like a bonfire that night and the next day," he said to me one day when I was explaining my book project to him. "Also, my clothes smelled like a bonfire, of course, so it must require lots of extra laundering."

According to news reports, there are so many bonfires lit on Lag B'Omer that satellite images reveal a smoky haze hovering over Israel during the holiday. Scientific research has shown that visits to emergency rooms for asthma and chronic obstructive pulmonary disease (COPD) occurrences go way up because of the smoke, which is hardly surprising since the concentration of particulate matter on the evening of the holiday can spike to as much as ten times the normal level. Government officials in Israel are well aware of the problem. A study authorized by the Knesset showed that the bonfires contribute to the problem of global warming, and that body has recommended (though not required) that people refrain from lighting them. The message has not been well received in most quarters. When an influential local mayor launched a campaign to convince residents to find alternative methods of celebrating the holiday, the people became outraged. As one journalist wrote: "In an instant, the popular mayor became the local killjoy, the Grinch who was trying to steal Lag B'Omer. The local press and town Internet forum erupted with residents blasting [the mayor] for his attempt to extinguish the flames. 'Next thing you know he'll be ordering us not to light Hanukkah candles,' one angry resident wrote." In fact, Hanukkah candles do contain hazardous substances like toluene, benzene, and formaldehyde, so it wouldn't be entirely shocking if somebody did try to ban them.

Beyond bonfires, the burning of incense is a fairly long-standing and ubiquitous religious practice found in all sorts of traditions, including Christianity, Hinduism, and Buddhism. Although incense can be sweet-smelling and pleasant, it is also really dangerous. For whatever reason (the smell, the

context, the different treatment by the media, the extreme irrationality of all human beings), people who would go miles out of their way to avoid breathing in the smoke from a single cigarette often have no problem hanging out for hours at a temple or church where the air is filled with billowing plumes of hazardous incense smoke.

When I was visiting Hong Kong, I spent an hour or so at the School of Public Health at the Chinese University of Hong Kong, talking to a research scientist named Kin-Fai Ho, whose work focuses on the effects of toxic air pollutants on human health. Professor Ho was part of a team of scientists who were granted rare access inside of two temples in Hong Kong so they could study the effects of incense burning on the air quality. The team found that during peak times, when incense was being burnt in high quantities, the air was far more polluted than during nonpeak times. At one of the temples, for instance, the peak carbon-monoxide level was three times the nonpeak level, and the average benzene concentration was almost eight times more than the government's recommendation for public places. When I asked Dr. Ho how incense smoke compares with cigarette smoke, he said the two were comparable with respect to particulate matter, carbon monoxide, and polycyclic hydrocarbons.

Temples and the people visiting them have several alternatives that can help reduce the risk from incense smoke. In their paper, Ho and his coauthors write that "visitors may decrease the number of incense sticks burned and period of stay at temples." In my travels, I did visit temples that tried to suggest limits on how many incense sticks people should burn. Some temples have tried to deal with this problem by extinguishing incense sticks after they have been burning for a while. Particularly in Hong Kong, I sometimes saw large buckets of water standing near places where large amounts of incense were being burnt, and every once in a while, a temple worker would grab a bunch of sticks and douse them in the water. There is one suggested possible solution, however, that Dr. Ho was not very optimistic about. So-called environmentally friendly incense, which is marketed in some places as a way of reducing the environmental and health impacts of incense burning, turns out, according to a new study that Ho was working on, to have slightly fewer particulate matter emissions but little effect on the amount of toxic pollutants emitted. On my way out of the interview, looking in that journalistic way for the bottom line, I asked Dr. Ho whether he thought incense-smoke inhalation was a problem. He looked at me and responded calmly, "Yeah, it's a big problem."

Another problem is fireworks. As someone who has always hated fireworks and would rather stay inside with my head under a pillow than endure a loud, smoky Fourth of July celebration with ten thousand people staring at the sky and going "oooooh" and "ahhh" over and over for half an hour, I find it hard to understand the appeal. But still, people love watching fireworks! Every celebration these days, from the biggest national holiday to the most insignificant home-run hit by a last-place baseball team down 14-0 in the bottom of the eighth inning, seems to be marked by a blast of colorful explosions. Religious celebrations are no exception. Chinese New Year celebrations, which for some take on a religious meaning (many believe the fireworks ward off evil spirits); the Muslim holiday of Eid, which marks the end of the Ramadan fasting period; the Hindu festival of lights known as Diwali; and many other religious holidays and festivals around the world are celebrated with the abundant lighting of firecrackers and fireworks.

Unfortunately, for those of us who need to breathe air in order to live, the smoke produced by fireworks can be quite dangerous. According to one academic paper that showed the effects of fireworks on air pollution during Diwali in India, "fireworks contain harmful chemicals such as potassium nitrate, carbon and sulphur apart from an array of chemicals such as strontium, barium, sodium, titanium, zirconium, magnesium alloys, copper and aluminum powder to create the colourful effects. On burning they release gases such as carbon monoxide and nitrogen dioxide." The study concluded that fireworks contributed to excessive ozone pollution spikes during the holiday, and that "high ozone levels combined with pollution due to fireworks might be critical for elderly people and

children with heart and respiratory ailments.” Another Indian expert similarly concluded, “Gaseous air pollutants along with other toxic gases emitted due to burning of firecrackers aggravates the chance of attack among asthma patients. The patients with heart disease, chronic bronchitis and low immune system are also at high risk.”

The realization that fireworks significantly raise air pollution levels has led officials in Beijing to call for a reduction in the use of pyrotechnics during the Chinese New Year period, and it's one reason, among others, that Abu Dhabi police have warned Eid celebrants not to use illegal fireworks in the United Arab Emirates. Even in the United States, some critics have called for the federal government to regulate fireworks, rather than exempting them from the ambit of the Clean Air Act. The EPA has refused, claiming that “Congress did not intend to require EPA to consider air-quality violations associated with such cultural traditions in regulatory determinations.”

Although most people probably conjure up images of a dark and smoggy sky when they think about air pollution, in fact indoor air pollution may be nearly as dangerous as outdoor pollution, particularly in developing countries where people routinely burn coal and biomass fuel for cooking and heating their homes. **Indoor air pollution also provides the context for one of the most bizarre examples of a religious practice that has created environmental problems in the United States.**

Mercury is an element that people generally do not want to mess with. Touching it, eating it, or, most dangerously, breathing in the vapors that it releases can be extremely dangerous, potentially causing respiratory problems and damage to the nervous system. Given the perils of inhaling mercury vapors, it might be surprising to learn that some religious believers actually sprinkle the silver liquid metal inside their homes to ward off evil spirits. The practice puts not only current residents at risk but also future ones, as mercury can remain in fabrics and carpets for up to a decade, releasing dangerous vapors the entire time.

Back in 1989, a middle school chemistry teacher in Brooklyn named Arnold Wendroff was teaching his students about the periodic table. When he asked his students if they knew what mercury was used for, he fully expected someone to mention thermometers. Instead, one of his students answered that his mother, a Santeria practitioner originally from Puerto Rico, liked to sprinkle it around their apartment to fend off witches. Witches? Concerned and curious, Wendroff soon became a one-man watchdog of the ritualistic use of mercury. He learned that many practitioners of Caribbean religions like Santeria, Palo, and Voodoo believe that mercury can bring good luck and keep evil spirits at bay. In large US cities with substantial populations of these believers, practitioners purchase capsules containing a small amount of liquid mercury from so-called botanicas, which are essentially stores that sell religious paraphernalia.

The practitioners then do things like sprinkle the mercury on floors, furniture, or car interiors, or mop the floor with it, or burn it in candles, or mix it with perfume, or even swallow it. Because mercury vapors are so dangerous to inhale and because the mercury remains in the environment for so long, Wendroff concluded that the ritualistic use of mercury posed a significant health hazard that the government needed to address.

Through Wendroff's efforts, the EPA became aware of the problem in the early 1990s and started considering whether to do anything about it. The agency has several statutes that it could have used to regulate the ritual use of mercury inside homes, most importantly the Toxic Substances Control Act, or TSCA, which allows the agency to take a wide variety of regulatory actions against substances that pose an unreasonable risk to the environment or public health. To look into the issue, the EPA established a task force that conducted research and interviewed interested parties. Ultimately,

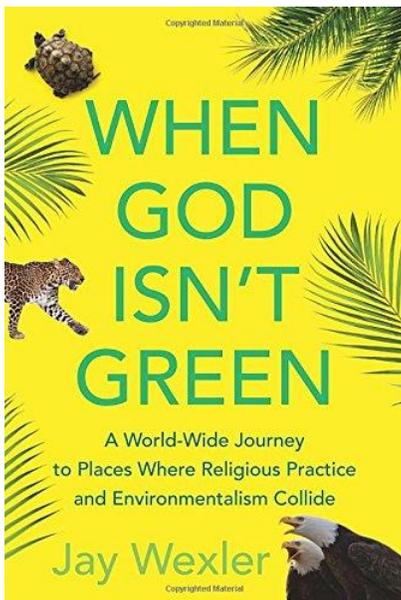
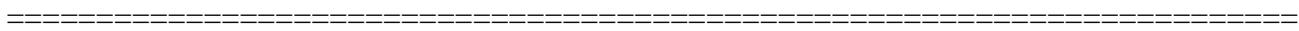
though, the agency decided against using the TSCA, opting instead to work together with states and municipalities to spread the word about the dangers of mercury through education and community outreach.

In the wake of the task force's decision, Wendroff continued to call for further efforts to address the indoor religious mercury problem, talking to the media, writing papers in scientific journals, and interacting with various governmental units. In 2005, he asked the Office of the Inspector General at EPA to "determine whether EPA had adequately investigated whether [indoor religious mercury] contamination poses an environmental health threat and, if so, had EPA substantively acted to address its dangers." Unsurprisingly, the OIG concluded that EPA had acted properly and recommended no further action. On the other hand, the office did release a report on its investigation "to further emphasize that the ritual use of mercury poses a health risk." This final conclusion does seem to be accurate. A 2011 article in the *New York Times*, for instance, reported on the case of a three-year-old who suffered mercury poisoning when her family moved into a Rhode Island apartment that had been the site of ritual mercury use by a former tenant many years earlier.

Excerpted from *When God Isn't Green: A World-Wide Journey to Places Where Religious Practice and Environmentalism Collide* by Jay Wexler (Beacon Press, 2016). Reprinted with Permission from Beacon Press.

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Mercury Use in *Espiritismo*: A Survey of Botanicas

Despite the well-known hazards of mercury exposure,¹⁻⁵ practitioners of *espiritismo*, a spiritual belief system indigenous to Puerto Rico and other Caribbean islands,⁶ have been reported to use mercury.⁷⁻⁹ We surveyed New York City stores selling mercury for spiritual practice to clarify misperceptions and alert public health workers about possible mercury presence in homes in which *espiritismo* is practiced.

Mercury goes by the name of *azogue* and is sold in botanicas, stores that specialize in selling religious items used in *espiritismo*, voodoo, and Santeria, a Cuban-based religion that venerates both African deities and Catholic saints. Botanicas also sell herbs used in folk medicine and for general health promotion.

Our interviewer visited 41 botanicas in low-income New York City Hispanic communities between March and May of 1995, asking store personnel about the cost, sales, uses, and purchasers of mercury. We found that nearly 93% of botanicas sold about one to four capsules (about 9.0 g⁹) of mercury daily at an average cost of \$1.50 (see Table 1). Botanica personnel estimated that Puerto Ricans, Dominicans, and "other Hispanics" make up about 90% of mercury buyers and that more than two thirds of buyers are women.

Mercury is usually recommended by family members, spiritualists, card readers, and santeros (practitioners of *Santeria*). The two primary reasons given for mercury use are for good luck and protection from evil and the envy of others. Through anecdotes, we learned that because mercury "flows smoothly," it provides good luck and, as a result of its slippery nature, prevents evil from sticking to the person. The most often recommended manner of using mercury is carrying it on one's person in a sealed pouch that should be prepared by someone with spiritual "powers." Sprinkling mercury in the home is another common form of use.

Yearly sales in Bronx 25,000 to 155,000 (median 47,000) 9 gram capsules per year. Equals 506 lbs. - 3,080 lbs/yr. Between 8,000 and 51,000 (median 13,000) homes per year contaminated in the Bronx.

See Report of EPA Superfund's 'Ritualistic Uses of Mercury Task Force' at www.epa.gov/mercury/ under 'Reports and Publications.' Also see the web site of the Mercury Poisoning Project www.mercurypoisoningproject.org/

Our survey shows that mercury is quite easy to purchase, and the manner of use may create situations of constant exposure to potentially high levels of mercury vapors in the immediate atmosphere. Of course, more research is needed. In particular, explorations of mercury levels in inner-city communities should include adherents of spiritualism as well as nonadherents since the latter may be exposed unwittingly to mercury poisoning by residing in apartments and homes previously inhabited by mercury-sprinkling tenants. Also, because of mercury's neurobehavioral effects, pediatricians, psychiatrists, and learning specialists should be alert to its potential presence in children.^{2,4,5,10}

As providers of community health and mental health services in underserved areas, we recognize the public health threat of dispensing mercury. However, we recommend also that the dangers of mercury be sensitively separated from the social-psychological benefits of spiritualism. In inner-city Hispanic communities, *espiritismo* is an indigenous source of community socialization and support. Spiritualists frequently represent the first line of extrafamilial mental health intervention. Since botanicas also sell medicinal plants and herbal remedies, they offer some basic health care familiar to the cultures of Latin America. Therefore, public health interventions must be aimed at helping spiritualists find safe alternatives to mercury. □

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TABLE 1—Reports by Botanica Personnel of Mercury Sale and Use for Spiritual Practices, New York City

Mercury Sale and Use Data	Botanicas Reporting (n = 41), No. (%)
Sale	
Sell mercury	38 (92.7)
Do not sell	3 (7.3)
Volume of daily sales^a	
1-4 capsules	20 (48.7)
5-10 capsules	12 (29.2)
11 or more capsules	3 (7.3)
Dispensing forms	
Capsules	33 (80.5)
Larger quantities	2 (4.8)
Both forms	3 (7.3)
Source of recommendation for mercury use^b	
Family member	16 (39.0)
Spiritualist	16 (39.0)
Friends	15 (36.5)
Card reader	14 (34.1)
Self	9 (21.9)
Santero	4 (9.7)
Books	1 (2.4)
Condition for which recommended^b	
Luck in love, money, work, health	32 (78.0)
Protection against evil	23 (56.0)
Protection from envy	1 (2.4)
Method of use^b	
Carried in sealed pouch	20 (48.8)
Sprinkled in home	12 (29.3)
Carried in pocket	13 (31.7)
Sprinkled in car	1 (2.4)
Consumed in small quantities	1 (2.4)

^aOnly 35 botanicas provided information on daily or weekly sales.

^bOften, more than one source, condition, or method was reported; therefore, percentages exceed 100%.

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REPORTS BY BOTANICA PERSONNEL OF MERCURY SALE AND USE FOR SPIRITUAL PRACTICES, BRONX, NEW YORK CITY, 1995

After: Zayas & Ozuah AJPH 1/96:112-113

Mercury Sale and Use Data

Botanicas Reporting
(n = 41)
No. (%)

Botanica mercury sales		
Sell mercury	38	(92.7)
Do not sell	3	(7.3)
Volume of daily mercury sales^a		
1-4 capsules	20	(48.7)
5-10 capsules	12	(29.2)
11 or more capsules	3	(7.3)
Mercury dispensing forms		
Capsules	33	(80.5)
Larger quantities	2	(4.8)
Both forms	3	(7.3)
Source of recommendation for mercury use^b		
Family member	16	(39.0)
Spiritualist	16	(39.0)
Friends	15	(36.5)
Card Reader	14	(34.1)
Self	9	(21.9)
Santero	4	(9.7)
Books	1	(2.4)
Condition for which mercury was recommended^b		
Luck in love, money, work, health	32	(78.0)
Protection against evil	23	(56.0)
Protection from envy	1	(2.4)
Method of mercury use^b		
Carried in sealed pouch	20	(48.8)
Sprinkled in home	12	(29.3)
Carried in pocket	13	(31.7)
Sprinkled in car	1	(2.4)
Consumed in small quantities	1	(2.4)

Based on this data, Wendroff calculated that the median number of mercury capsules/vials (mean weight 9 grams) sold in 1995 by Bronx botanicas was 47,000 or 930 pounds. Riley calculated the range of such sales at from 506 pounds to 3,080 pounds per year. This is the equivalent of from 25,500 to 155,000 (9 gram) capsules/vials per year.

^aOnly 35 botanicas provided information on daily or weekly sales.

^bOften, more than one source, condition, or method was reported; therefore, percentages exceed 100%.

ESTIMATE OF TOTAL YEARLY MERCURY SALES, NUMBER OF DWELLINGS POLLUTED, AND NUMBER OF INDIVIDUALS EXPOSED TO MERCURY (Based on above data.)

"Volume of daily mercury sales"

# Botanicas selling mercury	Range in Table # caps/day	Midpoint of daily sales (conservative)	Calculated # capsules sold per day
20	1 - 4	2	20 x 2 = 40
12	5 - 10	7	12 x 7 = 84
3	11 - ?	11	3 x 11 = 33
Totals:	35		157

Thus, 157 capsules sold per day, multiplied by 300 days per retail year, equals some 47,000 capsules sold per year. Of these, 29.3%, or 13,800 dwellings per year will be sprinkled with mercury. If there are but 2 inhabitants per dwelling, there will be 27,600 individuals exposed to toxic mercury levels per year in this area.

We are support of Hartford Coalition for Safe Technology and We are part of Hartford Coalition for Safe Technology we are concerned about these antennas that are being put in our community African American and Latino America are concern about the radiation level going into our community this is Environmental Health Issue for our seniors our children and our future

Bethany Spencer And

Sherman Bowens of the

(C.I.A.)Community Improvement Association

Thank you ever so much please truly look into this matter seriously

August 18, 2022

Brenda Staudenmaier
Green Bay WI 54301
Brendalovesh2o@gmail.com

Dear White House Environmental Justice Action Council (WHEJAC):

I have spoken at a few of the past meetings and made written comment. I am a Plaintiff in a Federal TSCA Lawsuit against the US EPA over the neurotoxicity of fluoride chemicals added to the public drinking water supply. I work in the WI water industry, and I am a mother of two children. Sitting through these WHEJAC and NEJAC meetings makes me realize that there is an overwhelming amount of social justice issues in the US and the government has played a role in many of them. Either by active participation or by negligence of not addressing an issue, the US Government needs WHEJAC and NEJAC to hold them accountable. I hope that this committee is not an attempt by the Biden Administration to make it look as if they care about us and our issues and that they are prioritizing EJ issues, but they will take no actual action to remediate these problems and this group has no real power to take any action. I hope that this is not the case and that your group does have some real power to make simple changes that will have a large impact on improving and protecting human health and the environment.

According to the US EPA, "Fluoridation is not required by EPA, which is prohibited by the Safe Drinking Water Act from requiring the addition of any substance to drinking water for preventive health care purposes." Fluoride is just as neurotoxic to the brain as lead. The US is spending billions of dollars for lead removal while adding fluoride chemicals that are known to contain trace amounts of each lead and arsenic. Why would anyone want arsenic and lead purposely added to their water and why does EPA and other governmental agencies turn a blind eye to this?

Fluoride is a public health failure that wastes a lot of money. CDC and HHS both waste lots of money on fluoride. The CDC wastes money on the Community Water Fluoridation Quality Awards program to give participation awards to water utilities. They also waste loads of money on fluoridation program coordinators who are typically undereducated dental hygienists who have no credentials to be making public comments about the issue of fluoride and neurotoxicity, yet these coordinators are being used to deny harm and reassure the public fluoride is safe. It is estimated that 4.5 million IQ points are lost per year due to fluoride neurotoxicity. Around \$100 billion per year is the economic harm from IQ loss from fluoride neurotoxicity and is much higher than any possible dental benefit estimates that are often used as talking points to protect the water fluoridation program. CDC and HHS waste money on oral health staff to protect fluoridation and to deny harms to the brain and body instead of concentrating on nutrition and diet while resolving food insecurity issues.

The US Government has a history of recommending harmful levels of fluoride and knowing that it has harmed some people. In the 1960s they knew fluoride harmed blacks with higher rates of dental fluorosis damage. It is documented in *INDIAN HEALTH SERVICE CIRCULAR NO. 81* that Indian Health Services fluoridated US Indian Schools and communities with brain damaging high levels of fluoride based on HHS recommendations in the 1980s. These agencies continue to harm those who are most susceptible today while twisting the science to protect the fluoride program.

I have seen CDC and HHS staff misrepresenting the latest fluoride science in live Zoom meetings. On Thursday, March 11, 2021, CDC participated in a Town Hall with Federal Agency Staff before their March 17th Capitol Hill Day to lobby politicians on fluoride. Casey Hannan, Director Centers for Disease Control and Prevention, Division of Oral Health was asked a question about the current science on neurotoxicity of fluoride added to public drinking water. Hannan's response was "bottom line is that the studies that have been published to date whether it's that ones or ones across the world they're looking at exposure to fluoride levels that are much higher than the recommended 0.7 milligrams per liter that the US has." His statement is false because the studies that were being discussed were the NIH funded neurotoxicity studies that were done at levels relevant to water fluoridation. For example, the well-known Green et al study was conducted in areas where fluoride concentration is 0.6mg/L in Canadian water.

<https://linkinghub.elsevier.com/retrieve/pii/S0889540622001007>

The CDC website links to notorious groups known for bullying, lying, and lobbying to protect and expand water fluoridation. The American Fluoridation Society (AFS) is linked by CDC as a group to go to for more information on water fluoridation.

<https://www.cdc.gov/fluoridation/organizations/index.htm>. In 2020, the AFS President Johnny Johnson told my Green Bay City Council members that the Federal Fluoride Lawsuit Case No. 17-cv-02162-EMC, against the US EPA over the neurotoxicity of fluoride chemicals added to water, is not about water fluoridation but about the Toxic Substance Act. The statement is archived at 4:31:01 stating, "which was what, about the toxic substance act, not about actual fluoridation."

<https://youtu.be/Gz5aBkuZ6Xw?t=16261> I am a Plaintiff in a Federal Toxic Substances Control Act (TSCA) lawsuit against the US EPA over the neurotoxicity of fluoride chemicals that are added to the public drinking water supply. Contrary to Johnny's claim, Our lawsuit is exactly about water fluoridation. https://www.govinfo.gov/app/details/USCOURTS-cand-3_17-cv-02162 I am not sure how our water fluoridation lawsuit can be misconstrued by Johnny Johnson and the AFS. Johnny Johnson also misrepresents the neurotoxicity research on fluoride and statements made by Dr. Christine Till which prompted her to respond with a letter to my Green Bay Council that is included in this submission. Myron Allukian Jr., Vice President of the AFS, has participated in bullying efforts against Dr. Till with forceful critiques of her publications and letters to her university because of her research associating community water fluoridation with significant harm. I also believe Myron Allukian has bullied and threatened Dr. Grandjean from Harvard T.H. Chan School of Public Health for his publications on fluoride and neurotoxicity. The AFS is not an ethical or reliable resource on fluoride science, and it makes the CDC look incredible linking to this association.

EPA has known fluoride is a red flag for many years. The 2006 National Research Council recommended EPA lower their MCL for fluoride because of adverse health effects. To this date, EPA has failed to take any action. The 2006 National Resource Council review of Fluoride and EPA's Standard, stated, "On the basis of information largely derived from histological, chemical, and molecular studies, it is apparent that fluorides have the ability to interfere with the functions of the brain and the body by direct and indirect means." p.222

<https://nap.nationalacademies.org/catalog/11571/fluoride-in-drinking-water-a-scientific-review-of-epas-standards>. US EPA scientists listed fluoride as a "Chemical with substantial evidence of developmental neurotoxicity" in 2009.

https://www.researchgate.net/publication/266871638_Building_a_Database_of_Developmental_Neurotoxicants_Evidence_from_Human_and_Animal_Studies A 2020 Meta-Analysis of Stressors from the Total Environment Associated with Children's General Cognitive Ability by EPA researchers found that, "Fluoride was observed to have the greatest increase in impacting cognitive ability and it is often reported to affect memory and cause cognitive deficits." Fluoride stressed the brain and cognitive abilities at rates of 8 times the average for all "toxic element stressors" and 13 times lead's effect.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7432904/>. The EPA has been dragging their feet on the issue of fluoride and neurotoxicity which required myself and others to file a Federal TSCA Lawsuit. This lawsuit is costing us and EPA millions of dollars in legal fees when they could have invested that money into doing a proper assessment on fluoride's neurotoxic abilities and banned the practice.

Most countries have rejected fluoridation as an unwise and unethical intervention, while some have banned artificial fluoridation schemes. May 19, 2022, Pennsylvania State College Borough Water Authority (SCBWA) published a Fluoride Subcommittee Report entitled *Should we continue to fluoridate our water?* The report documents European Health, Water, & Environment Authorities do not accept potential side effects so that a minority may benefit.

- Switzerland: discontinued fluoridation after 41 years because other measures were of "comparable effectiveness" to "compulsory medication"
- Belgium: "...the fundamental position of the drinking water sector ...is not...to deliver medicinal treatment to people."
- Finland: "We do not favor or recommend fluoridation of drinking water. There are better ways of providing the fluoride our teeth need."
- France: "Fluoride chemicals are not included in the list of chemicals for drinking water treatment. This is due to ethical as well as medical considerations."
- Germany: "Generally, in Germany, fluoridation of drinking water is forbidden. The argument of the Federal Ministry of Health against a general permission of fluoridation of drinking water is the problematic nature of compulsory medication."
- Norway: "...we had a rather intense discussion on this subject some 20 years ago, and the conclusion was that drinking water should not be fluoridated."



Fluoride

Chemicals with Substantial Evidence of Developmental Neurotoxicity

Mundy et al. Building a Database of Developmental Neurotoxicants: Evidence from Human and Animal Studies (2009)

https://www.researchgate.net/publication/266871638_Building_a_Database_of_Developmental_Neurotoxicants_Evidence_from_Human_and_Animal_Studies

EPA Office of Research & Development

A Meta-Analysis of Stressors from the Total Environment Associated with Children's General Cognitive Ability (2020)

"Fluoride was observed to have the greatest increase in impacting cognitive ability (OR = 1.40, $p \leq 0.05$) & it is often reported to affect memory & cause cognitive deficits."



Fluoride stressed the brain & cognitive abilities at rates of 8 times the average for all "toxic element stressors" & 13 times lead's effect.

www.ncbi.nlm.nih.gov/pmc/articles/PMC7432904

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7432904/>

Michigan Study - Grand Rapids

OPTIONAL FORM NO. 10
5010-104
UNITED STATES GOVERNMENT

Memorandum

TO : Chief, Disease Control Branch *HR*
 : Division of Dental
 : Public Health and Resources

DATE: January 10, 1962

FROM : Sanitary Engineer Director
 : Division of Dental Public Health and Resources

Refer to: DPR-DC

SUBJECT: Optimum Fluoride Levels

Dr. Russell told me today that negroes in Grand Rapids had twice as much fluorosis as others - (indices of 0.15 vs 0.35). In a community with a larger number of negroes (say in DeKalb County, Georgia) would this tend to change our optimum fluoride levels? Would this observation indicate more studies in case opponents use this finding?

[Signature]
 F. J. Maier



The US Government has known since 1962 that fluoride harms blacks with fluorosis which is currently estimated to have damaged 70% of adolescents. Associations of low level of fluoride exposure with dental fluorosis among U.S. children and adolescents, NHANES 2015-2016. (2021) <https://pubmed.ncbi.nlm.nih.gov/34166938/>



Corporate Office
2381 Rossgate
Roseville, Minnesota 55113
Phone: (612) 331-6910
Fax: (612) 331-5304

PRODUCT DATA SHEET

Hydrofluosilicic Acid 23-25%

PDS - 1120; REVISION 05
EFFECTIVE DATE: 02 NOV 20

General Characteristics:

Appearance: Clear, colorless to light yellow solution
Odor: Pungent
Chemical Formula: H₂SiF₆
Molecular Weight: 144.09
CAS#: 16961-83-4
Freezing Point: 4° F
Boiling Point: 222.5° F
Shelf Life: 730 days
Storage Recommendations: In accordance with AWWA B703- Fluorosilicic Acid

Standard Specifications:

COMPONENT	SPECIFICATION
Assay, wt.%	23.0 – 25.0
Free Acid (as HF), wt.%	≤ 1.00
Fluorine (F), wt.%	18.00 – 21.00
★ Lead (Pb), ppm	★ ≤ 50
★ Arsenic (As), ppm	★ ≤ 50
Iron (Fe), ppm	≤ 100
P ₂ O ₅ , wt.%	≤ 0.5
PHYSICAL PROPERTIES	
Specific Gravity, 60° F	1.210 – 1.240

Additional Information:

AWWA Standard: Product meets AWWA Standard B703 for Fluorosilicic Acid.

Bioterrorism Act of 2002: All appropriate Hawkins, Inc. facilities are registered with the FDA per the Public Health Security and Bioterrorism Preparedness and Response Act of 2002.

Country of Origin: Product is manufactured in the United States.

NSF Certification: Certified to NSF ANSI/Std. 60 with a maximum use level of 6 mg/L.

Notice for Product Numbers: 1100, 1102, 1125, 1135, 1145, 1160, 32665, 34124, 41868, 57273 ("Product(s)")

Hawkins, Inc. ("Hawkins") presents the information in this Product Data Sheet ("Information") in good faith and believes the Information to be accurate as of the Effective Date. Hawkins warrants only that when Hawkins ships the Product, it will meet published specifications. Other than this warranty, HAWKINS MAKES NO OTHER REPRESENTATION OR WARRANTY, EITHER EXPRESS OR IMPLIED, FOR COMPLETENESS, ACCURACY, MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR ANY OTHER NATURE WITH RESPECT TO THE INFORMATION, OR TO THE PRODUCT TO WHICH THIS INFORMATION REFERS. Hawkins will not be responsible for damages of any nature whatsoever resulting from the use of, or reliance upon, the Information or the Product to which the Information refers.

Page 1 of 1

If fluoride is safe for public health, then why is there lead and arsenic in the chemicals being used? Hydrofluosilicic acid is the contaminated fluoride chemical being used in many municipalities that add fluoride to the public drinking water supply. Green Bay Water Utility uses the above chemical listed in the Product Data Sheet. The EPA MCL Goal for each lead & arsenic are zero yet these fluoride chemicals contain trace amounts of lead & arsenic. When municipalities add fluoride, they should be required to include the product data sheet (PDS), safety data sheets (SDS), and the source of raw material to the EPA website scorecard so the public can easily access this information.

FLUOROSILICIC ACID

23 % - 25%

UN No. 1778

CAS No. 241-034-8

See SDS Further Information

DANGER

HARMFUL IF SWALLOWED OR IF INHALED.

TOXIC IN CONTACT WITH SKIN

CAUSES SEVERE SKIN BURNS AND EYE DAMAGE

CAUSES SERIOUS EYE DAMAGE

Wear protective gloves, clothing, eye protection, and face protection. Avoid breathing dust/fumes/gas/mist/vapors/spray. Use only outdoors or in a well ventilated area. Wash skin thoroughly after handling. Do not eat, drink or smoke when using. **IF INHALED:** Remove victim to fresh air and keep comfortable for breathing. Immediately call a poison doctor/center. **IF ON SKIN:** Immediately take off all contaminated clothing. Rinse skin water/shower. **IF IN EYES:** Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing. Immediately call a poison doctor/center. **IF SWALLOWED:** Rinse mouth. Do not induce vomiting. Wash clothing before reuse. Absorb spillage to prevent material damage. Collect spillage. Store locked up. Store in corrosive resistant container with a resistant inner liner. Dispose of contents/container to an approved waste disposal plant.



For Help In Emergencies
Involving Spill, Leak, Fire or Exposure - Call 24 hours
CHEMTREC 1-800-424-9300

Martelle Water Treatment
3304 W Rockport Rd/ Janesville, WI 53548
608-314-9371

Martelle
WATER TREATMENT
3304 W ROCKPORT - JANESVILLE, WI 53548
608-314-9371

HFS

NFPA

FLAMMABILITY	0
HEALTH	3
REACTIVITY	0
INSTABILITY	0
HAZARD	

D.O.T.
UN1778, FLUOROSILICIC ACID,
8, PG II

CORROSIVE

8

NSF

Certified to NSF/ANSI 372
MAX USE IN POTABLE WATER
6 mg/l

For Help In Emergencies Involving Spill, Leak, Fire or Exposure
Call 24 hours - CHEMTREC 1-800-424-9300

HFS label on the fluoride chemicals in Wisconsin.

4. CONTROL LIMITS, SAMPLE COLLECTION, AND ANALYSIS AND REPORTING REQUIREMENTS

1. Control Limits

The fluoride level in fluoridated water systems should be maintained as close to the recommended concentration as possible, and in no case above or below the ranges noted below.

Annual Average of Maximum Daily Temperatures (oF)	Recommended Fluoride Concentrations Community/School (ppm)	Allowable Range of Fluoride Concentrations Community/School (ppm)
50.0 - 53.7	1.2 / 5.4	1.1-1.7 / 4.3 - 6.5
53.8 - 58.3	1.1 / 5.0	1.0 - 1.6 / 4.0 - 6.0
58.4 - 63.8	1.0 / 4.5	0.9 - 1.5 / 3.6 - 5.4
63.9 - 70.6	0.9 / 4.1	0.8 - 1.4 / 3.3 - 4.9
70.7 - 79.2	0.8 / 3.6	0.7 - 1.3 / 2.9 - 4.3
79.3 - 90.5	0.7 / 3.2	0.6 - 1.2 / 2.6 - 3.8

INDIAN HEALTH SERVICE CIRCULAR NO. 81-08 These fluoride levels were recommended and allowed by HHS for Indian communities and schools but are known today to damage the human brain and many of these concentrations exceed the current EPA Maximum Contaminant Level (MCL) of 4.0ppm and MCL Goal of 2ppm.

US GOVERNMENT FUNDED HUMAN FLUORIDE BRAIN STUDIES

Year, Grants	Author, Study, Journal	Finding
2022 (July 16) NIEHS	Goodman et al. <u>Iodine Status Modifies the Association between Fluoride Exposure in Pregnancy and Preschool Boys' Intelligence</u>	<p>“We evaluated whether the maternal urinary iodine concentration (MUIC) modifies the association between maternal urinary fluoride (MUF) and boys’ and girls’ intelligence. We used data from 366 mother–child dyads in the Maternal–Infant Research on Environmental Chemicals Study....</p> <p>“For boys whose mothers had low iodine, a 0.5 mg/g increase in MUF_{CRE} was associated with a 4.65-point lower FSIQ score (95% CI: -7.67, -1.62). For boys whose mothers had adequate iodine, a 0.5 mg/g</p>

	Journal: Nutrients	increase in MUF _{CRE} was associated with a 2.95-point lower FSIQ score (95% CI: -4.77, -1.13). These results suggest adequate iodine intake during pregnancy may minimize fluoride’s neurotoxicity in boys.”
2022 (April) NIEHS	Goodman et al. <u>Maternal fluoride exposure, fertility and birth outcomes: The MIREC cohort.</u> Journal: Environmental Advances	Data on fertility, birth weight, gestational age, preterm birth, and small-for-gestational age (SGA) were assessed... fluoride exposure during pregnancy was not associated with these birth outcomes.
2022 (March) NIH, NIEHS, EPA	Goodman et al. <u>Domain-specific effects of prenatal fluoride exposure on child IQ at 4, 5, and 6–12 years in the ELEMENT cohort.</u> Journal: Environmental Research	“The negative association between prenatal fluoride exposure and longitudinal IQ was driven by decrements in non-verbal intelligence (i.e. PIQ [Performance IQ]), suggesting that visual-spatial and perceptual reasoning abilities may be more impacted by prenatal fluoride exposure as compared to verbal abilities.”
2022 (Feb) NIEHS	Spinu et al. <u>Probabilistic modelling of developmental neurotoxicity based on a</u>	This paper is complex and contains many Figures and Tables. <u>Figure 4</u> ranks Sodium Fluoride (NaF) in the medium category for developmental neurotoxicity. <u>Figure 3</u> shows probability of NaF for impairment of learning, memory and cognitive function.

	<p><u>simplified adverse outcome pathway network.</u></p> <p>Journal: Computational Toxicology</p>	
<p>2021 (Dec)</p> <p>NIEHS</p>	<p>Adkins & Brunst:</p> <p><u>Impacts of Fluoride Neurotoxicity and Mitochondrial Dysfunction on Cognition and Mental Health: A Literature Review.</u></p> <p>Journal: International Journal of Environmental Research and Public Health</p>	<p>“... there is no agreed-upon mechanism for the neurotoxic effects of fluoride; however, fluoride can induce mitochondrial damage, including decreasing circulating mitochondrial DNA content, dysregulating biogenesis, and circular structure loss. Additionally, many neurodevelopmental conditions have mitochondrial underpinnings. More work is needed to elucidate the impact and timing of fluoride exposure on mental health and the role of mitochondrial function as a biological mechanism.”</p>
<p>2021 (Oct)</p> <p>NIEHS</p>	<p>Adkins et al.</p> <p><u>Fluoride exposure during early adolescence and its association with internalizing symptoms.</u></p> <p>Journal: Environmental Research</p>	<ul style="list-style-type: none"> • Adolescents with elevated urinary fluoride concentrations exhibit more somatization symptoms. • Males may represent an at-risk population for fluoride-related internalizing behaviors. • While somatization is typically comorbid with anxiety and depression, fluoride concentrations were not associated with increased depressive or anxiety symptoms. <p>“This is the first study to link fluoride exposure and internalizing symptoms, specifically somatization. Somatization represents an interface of physical and</p>

		psychological health. Continued follow-up will help shed light on the sex-specific relationship between fluoride and mental health and the role of somatization.”
2021 (Aug) NIEHS	Cantoral et al. <u>Dietary fluoride intake during pregnancy and neurodevelopment in toddlers: A prospective study in the Progress Cohort.</u> Journal: NeuroToxicology	Lowered IQ “In the mixed-effects longitudinal model, we observed a statistically significant negative association between dietary fluoride intake in pregnancy and cognitive score (averaged across both time points) in boys, but not girls (interaction p value = 0.07) (Table 4). “These findings suggest that the development of nonverbal abilities in males may be more vulnerable to prenatal fluoride exposure than language or motor abilities, even at levels within the recommended intake range.”
2021 (June) NIEHS	Grandjean et al. <u>A Benchmark Dose Analysis for Maternal Pregnancy Urine-Fluoride and IQ in Children.</u> Journal: Risk Analysis	The analysis found that a maternal urine fluoride concentration of 0.2 mg/L was enough to lower IQ by 1 point. This level is exceeded 4 to 5 times in pregnant women living in fluoridated communities.
2021 (June) NIEHS,	Castiblanco-Rubio et al.	No significant observations made in this study.

<p>EPA</p>	<p><u>Dietary Influences on Urinary Fluoride over the Course of Pregnancy and at One-Year Postpartum.</u></p> <p>Journal: Biological Trace Element Research</p>	
<p>2021 (June)</p> <p>NIEHS</p>	<p>Ayele et al.</p> <p><u>Neuro-medical manifestations of fluorosis in populations living in the Main Ethiopian Rift Valley.</u></p> <p>Journal: Environmental Geochemistry and Health</p>	<p>Headache and joint pain reported by 67.1% and 56.3% of the participants as the most common neurological manifestation.</p>
<p>2021 (Feb)</p> <p>NIEHS</p>	<p>Cunningham et al.</p> <p><u>Fluoride exposure and duration and quality of sleep in a Canadian population-based sample.</u></p> <p>Journal: Environmental Health</p>	

<p>2020 NIEHS</p>	<p>Till et al. Fluoride exposure from infant formula and child IQ in a Canadian birth cohort. Journal: Environment International</p>	<p>Lowered IQ</p> <p>“In summary, fluoride intake among infants younger than 6 months may exceed the tolerable upper limits if they are fed exclusively with formula reconstituted with fluoridated tap water. After adjusting for fetal exposure, we found that fluoride exposure during infancy predicts diminished non-verbal intelligence in children...”</p>
<p>2020 (Sept) NIH</p>	<p>Farmus et al. Critical Windows of Fluoride Neurotoxicity in Canadian Children. Journal: Environmental Research</p>	<ul style="list-style-type: none"> • The strongest association between fluoride and Performance IQ was during the prenatal window; the association was also significant during infancy. • Within sex, the association between fluoride and PIQ significantly differed across the three exposure windows; among boys, the strongest association was during the prenatal window, whereas among girls, the strongest association was during infancy. • The susceptibility of infants to fluoride from drinking water is further amplified by their higher level of water intake than adults on a per body-weight basis (Snodgrass, 1992) and lower ability to detoxify exogenous compounds than adults. <p>In particular, formula-fed infants, whose formula is made with fluoridated water, have an approximate 70-fold higher fluoride intake than exclusively breastfed infants</p> <p>(Ekstrand, 1981; Zohoori et al., 2018; US EPA, 2010). Thus, level and timing of fluoride exposure are critical for determining the window of greatest vulnerability for neurodevelopmental outcomes.</p>

<p>2020 NIH, EPA</p>	<p>Uyghurturk et al. <u>Maternal and fetal exposures to fluoride during mid-gestation among pregnant women in northern California.</u> Journal: Environmental Health</p>	<p>The first U.S. study of urinary fluoride levels in pregnant women as well as fluoride levels in serum and the amniotic fluid of pregnant women.</p>
<p>2020 NIEHS</p>	<p>Green et al. <u>Sex-Specific Neurotoxic Effects of Early-Life Exposure to Fluoride: a Review of the Epidemiologic and Animal Literature.</u> Journal: Current Epidemiology Reports</p>	<p>Compared with females, male offspring appear to be more sensitive to prenatal, but not postnatal, exposure to fluoride. We discuss several sex-specific mechanisms and emphasize the need for future research.</p>
<p>2019 NIEHS</p>	<p>Green et al. <u>Association Between Maternal Fluoride Exposure During Pregnancy and IQ Scores in Offspring in Canada.</u></p>	<p>Lowered IQ “In this study, maternal exposure to higher levels of fluoride during pregnancy was associated with lower IQ scores in children aged 3 to 4 years. These findings indicate the possible need to reduce fluoride intake during pregnancy.”</p>

	Journal: JAMA Pediatrics	
2019 NIEHS, NIDCR, NIH	Lu et al. Fluoride related changes in behavioral outcomes may relate to increased serotonin. Journal: Physiology & Behavior	This is both a human and animal study. • Fluoride added to drinking water postnatally, resulted in reduced anxiety in mice. • Increased fluoride was associated with significantly increased serum serotonin in mice and in children. • Fluoride concentrations in brain increased with increased time of exposure. • Serotonin immunolocalization was increased in long term fluoride exposed brain.
2019 NIEHS	Grandjean P. Developmental fluoride neurotoxicity: an updated review. Journal: Environmental Health	Conclusion: The recent epidemiological results support the notion that elevated fluoride intake during early development can result in IQ deficits that may be considerable. Recognition of neurotoxic risks is necessary when determining the safety of fluoride-contaminated drinking water and fluoride uses for preventive dentistry purposes.
2018 NIEHS NIH	Bashash et al. Prenatal fluoride exposure and attention deficit hyperactivity disorder (ADHD) symptoms in	Higher concentration of maternal urinary fluoride was associated with more ADHD-like symptoms in school-age children. Prenatal exposure to fluoride was most strongly associated with behavioral ratings of inattention

	<p><u>children at 6–12 years of age in Mexico City.</u></p> <p>Journal: Environment International</p>	
<p>2018</p> <p>NIEHS</p> <p>NIH</p>	<p>Till et al.</p> <p><u>Community Water Fluoridation and Urinary Fluoride Concentrations in a National Sample of Pregnant Women in Canada.</u></p> <p>Journal: Environmental Health Perspectives</p>	<p>The first national survey in Canada of urinary fluoride levels in pregnant women.</p>
<p>2017</p> <p>NIEHS</p> <p>NIH,</p> <p>EPA</p>	<p>Bashash et al.</p> <p><u>Prenatal Fluoride Exposure and Cognitive Outcomes in Children at 4 and 6–12 Years of Age in Mexico.</u></p> <p>Journal: Environmental Health Perspectives</p>	<p>Lowered IQ</p> <p>“In this study, higher prenatal fluoride exposure, in the general range of exposures reported for other general population samples of pregnant women and nonpregnant adults, was associated with lower scores on tests of cognitive function in the offspring at age 4 and 6–12 y.”</p>

<p>2017</p> <p>NIEHS</p>	<p>Rango et al.</p> <p><u>Biomarkers of chronic fluoride exposure in groundwater in a highly exposed population.</u></p> <p>Journal: Science of The Total Environment</p>	<p>“The finding of exceptionally high F⁻ concentrations in water, fingernail clippings and urine in this region should motivate further investigations of other potential health consequences such as bone disease and abnormalities in the function of the neurological and endocrine systems.”</p>
<p>2016</p> <p>NIH</p>	<p>Thomas et al.</p> <p><u>Urinary and plasma fluoride levels in pregnant women from Mexico City.</u></p> <p>Journal: Environmental Research</p>	<p>“To our understanding, this is the first large exposure assessment of fluoride during multiple time points of pregnancy using two different biomarkers (urine, plasma). Where other studies have provided exposure data for the last trimester and delivery, our work examined exposure trends from the first month of pregnancy through delivery and found that levels in urine and plasma are relatively stable. Specifically, the population-average pattern of fluoride levels over time were fairly stable.”</p>
<p>2015</p> <p>NIH</p>	<p>González-Horta et al.</p> <p><u>A Concurrent Exposure to Arsenic and Fluoride from Drinking Water in Chihuahua, Mexico.</u></p> <p>Journal: International Journal of</p>	<p>“... significant differences were found in U-tAs and U-F⁻ levels between males and females. Specifically, urine from women contained on average less tAs (41.5 vs 59.4 ng/mL) and F⁻ (1.9 vs 2.4 µg/mL) than urine of men.</p> <p>“Notably, both signs of dental fluorosis and skin lesions typical of the chronic iAs exposure (keratosis and changes in pigmentation) were observed in several participants during the introductory medical exam (unpublished data). Previously, dental fluorosis was reported for 80% of the population in this area as a consequence of the high F⁻ levels in drinking water (0.7 to 8.6 mg/L) [40]. Although the adverse effects of the isolated exposures to iAs and F⁻ have</p>

	<p>Environmental Research and Public Health</p>	<p>been widely studied and are relatively characterized, the potential effects associated with the simultaneous exposure have not been systematically examined.</p> <p>“... immediate measures should be taken to reduce the exposure, particularly for vulnerable population, and specifically for pregnant women and children. The role of F⁻ exposure in the health risks previously attributed to iAs exposure alone [19,20] should be systematically studied.”</p>
<p>2015 NIDCR</p>	<p>Broadbent et al. <u>Community Water Fluoridation and Intelligence: Prospective Study in New Zealand.</u> Journal: American Journal of Public Health</p>	<p>This is one of <u>eight (8) fluoride IQ studies</u> that found no association between exposure to fluoride and reduced IQ. [74 studies found the opposite effect.] The NTP rated this study as relatively low quality and high risk of bias. There are several glaring problems with this study including the fact that virtually all of the children in the “non-fluoridated” community used fluoride supplements (a prescription drug designed to deliver the same amount of fluoride a child would get from drinking fluoridated water). FAN discusses these problems <u>here</u>.</p>
<p>2014 NIEHS NIH</p>	<p>Grandjean & Landrigan. <u>Neurobehavioural effects of developmental toxicity.</u> Journal: The Lancet Neurology</p>	<p>“In 2006, we did a systematic review and identified five industrial chemicals as developmental neurotoxicants: lead, methylmercury, polychlorinated biphenyls, arsenic, and toluene. Since 2006, epidemiological studies have documented six additional developmental neurotoxicants—manganese, fluoride, chlorpyrifos, dichlorodiphenyltrichloroethane, tetrachloroethylene, and the polybrominated diphenyl ethers.”</p>



PERSPECTIVE

Controversy: The evolving science of fluoride: when new evidence doesn't conform with existing beliefs

Christine Till¹ and Rivka Green¹

Over the past 75 years, health authorities have declared that community water fluoridation—a practice that reaches over 400 million worldwide—is safe. Yet, studies conducted in North America examining the safety of fluoride exposure in pregnancy were nonexistent. When a Canadian study reported that higher fluoride exposure in pregnant women was associated with lower IQ scores in young children, critics attacked the methodology of the study and discounted the significance of the results. Health authorities continued to conclude that fluoride is unequivocally safe, despite four well-conducted studies over the last 3 years consistently linking fluoride exposure in pregnancy with adverse neurodevelopmental effects in offspring. We describe the challenges of conducting fluoride research and the overt cognitive biases we have witnessed in the polarized fluoride debate. The tendency to ignore new evidence that does not conform to widespread beliefs impedes the response to early warnings about fluoride as a potential developmental neurotoxin. Evolving evidence should inspire scientists and health authorities to re-evaluate claims about the safety of fluoride, especially for the fetus and infant for whom there is no benefit.

Pediatric Research _#####_; <https://doi.org/10.1038/s41390-020-0973-8>

Do not avoid difficult areas of investigation. Take risks. If scientists exclusively choose the safe routes, avoid controversial research problems and play only minor variations of someone else's themes, they voluntarily turn themselves into technicians. Our craft will indeed be in peril.¹ Herbert Needleman, MD

Most people assume that community water fluoridation (CWF)—adding fluoride to public drinking water supplies—is a safe and effective way to prevent cavities. After all, it has been endorsed by public health, dental and medical organizations since it was introduced 75 years ago.^{2,3} Today, about three-fourths of people in the United States and one-third of Canadians have fluoride added to their drinking water.

After reviewing the scientific literature, it became clear that there were growing concerns about fluoride as a developmental neurotoxin.^{4,5} In 2006, a report by the National Research Council (NRC)⁶ acknowledged that fluoride exposure may be associated with adverse cognitive and endocrine outcomes, and recommended further study, especially for vulnerable populations. One NRC panel member, Dr. Isaacson, said the report “should be a wake-up call”. Yet, nearly 10 years later, not a single study had directly examined fetal exposure to fluoride in humans.

In many academic circles, it is a taboo to study fluoride. Dr. Phyllis Mullenix,⁷ former Head of the Toxicology Department at the Forsyth Dental Centre in Boston, was heavily criticized for publishing her study showing that sodium fluoride was neurotoxic to developing rats. People who questioned the safety of water fluoridation are quickly dismissed as zealots or anti-science fanatics. Indeed, some scientists dismissed our funding application with comments such as, “This study is not needed. We know that

fluoride is safe”. But we forged ahead; shouldn't claims about safety be based on evidence?

In 2015, we sought funding to investigate the safety of fluoride exposure in pregnancy. We assembled an interdisciplinary team of scientists from complementary fields including epidemiology, environmental health, neuropsychology, and dentistry—knowing that diverse perspectives would be critical for minimizing conscious or unconscious biases in our investigative process. We naively expected that the public health and medical community would trust the scientific process.

THE SCIENTIFIC PROCESS

We studied 512 mother–child pairs enrolled in the MIREC (Maternal Infant Research on Environmental Contaminants) study. The families lived in six Canadian cities; 40% lived in cities with CWF. To our astonishment, we found that higher levels of fluoride in pregnant women and water concentrations were associated with a 3- to 5-point lower IQ score in their 3- to 4-year-old children.⁸ We thought there may be other factors at play, but this association held up after accounting for important characteristics of the study population and looking at the relationship in many different ways.

In August 2018, we presented our findings at an international meeting held in Ottawa. We were nervous how the results would be received by the audience, which included members from Health Canada and other public health agencies. Afterwards, someone approached me and said, “Congratulations – you have just sabotaged your career before it even started”. Rivka Green

As part of our agreement, our manuscript required approval by the MIREC Biobank before we submitted it for publication.

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Considering the sensitive nature of the topic, the manuscript was sent to reviewers from various divisions of public health. In over 60 pages, we responded to over 200 specific critiques. The upshot of addressing each critique was that we were able to do better science by refining our methods.

We submitted the manuscript to three top medical journals; two did not send it for peer review because it was “of low research relevance”. As we waited, we hired an independent data analyst to rerun all of the analyses for the third time. In April 2019, *JAMA Pediatrics* accepted our paper. We responded to several additional rounds of review by the *JAMA* editors until we eventually reached a compromise that reflected the strength of the evidence, as well as their implications for public health.

One year after that conference in Ottawa, our article was published on August 19, 2019. In only 2 months, it was viewed over 100,000 times and ranked among the top 0.0005% of research output scored by Altmetric. We expected our study would reignite the debate about the safety of fluoridation, but we didn't expect we would be at the crossfire of this political and polarized debate.

THE BACKLASH

Outside of our colleagues in environmental epidemiology, who were initially skeptical, the results were met with resistance. Attempts to debunk the data were especially apparent from “experts” who held strong beliefs about the benefits and safety of fluoridation.

There are thousands of articles pointing to the safety of community water fluoridation ... this study doesn't change the benefits of optimally fluoridated water and exposure to fluoride.⁹ Dr. Braun, chair of the AAP Section on Oral Health Executive Committee

Yet, there are no other prospective studies with biomarkers of fluoride in pregnant women living in regions with CWF. Canada's national newspaper rang with the headline, “Fluoride won't make you dumber, but the ‘debate’ about its safety might”.¹⁰ Didn't the NRC deliberately call for more studies to address this “debate”?⁶

Vitriolic comments and claims with little scientific basis, such as the results are driven by outliers, were made by the American Council on Science and Health¹¹ and the UK-based Science Media Centre,¹² both heavily funded by the pharmaceutical and food and beverage industries. In reality, we presented our models with and without outliers and the effect remained. These types of vacuous claims exemplify attempts to manipulate the scientific evidence and manufacture doubt.

So what this study found was just an association. And we know from other areas ... they are inherently problematic and inherently complex.¹³ Timothy Caulfield, University of Alberta

This was not a scholarly debate on the neurotoxicity of fluoride; it was an attack on IQ scores, statistical methodology, and observational studies. Ironically, the evidence showing that CWF protects against tooth decay was largely based on observational or “association” studies, most of which were conducted prior to the introduction of fluoridated toothpaste in the early 1970s.¹⁴ Moreover, most landmark studies in public health—including those linking smoking with lung cancer, air pollution with coronary heart disease, and asbestos with mesothelioma—were observational. Indeed, this design is optimal to study many important public health problems, usually in conjunction with toxicological studies.

There is no sensible biochemical reason why fluoride would harm the brains of boys but not those of girls. So, are the authors wrong? Probably.¹⁵ Alex Berezow, Ph.D., Vice President of Scientific Affairs, American Council on Science and Health

Our paper continued to be attacked in scientific and public arenas, many of them drawing upon critiques made by the industry-funded groups. Accusations that our data did not support our conclusions spread quickly and were propagated by social media. “Experts” wrote that the association between maternal urinary fluoride and lower IQ in males, but not females, defied plausibility. However, as we noted in our original proposal, males are often more susceptible to toxicants and failure to examine sex-specific effects of fluoride exposure may result in missing a potentially vulnerable group. Further, the NTP in 2016 specifically called for more studies on fluoride exposure with an emphasis on sex-specific associations.¹⁶

I'm confused as to why the authors would want to withhold the data.¹⁷ Stuart Ritchey, Ph.D.

On October 23, 2019, a letter signed by 30 health-care professionals and scientists from six countries was sent to the Acting Director and Acting Deputy Director of the NIEHS. The letter cited concerns about the replicability of scientific research in general and the need for transparency. Our research team was accused of “refusing to release data”, but we had not refused to release the data. The policies that govern access to the MIREC Biobank and procedures to access it are sent to anyone who requests the data.

RISK AND BENEFITS

Some critics maintained that our conclusion—that pregnant women should reduce their fluoride intake—overstated the implication of the findings and was “dangerous”. Other critics said that we should not change our actions based on “one study”. We agree that no one study is definitive; we should carefully evaluate the collective evidence from multiple studies, as well as the risks and benefits of fluoridation.

Four high-quality, prospective birth cohort studies^{5,8,18,19} show that fetal exposure to fluoride is associated with diminished cognitive abilities. In November 2019, the National Toxicology Program released a draft report on fluoride concluding that fluoride is presumed to be a cognitive neurodevelopmental hazard. This report was largely ignored by the critics of our study.^{17,20}

Fluoride offers no benefits to the fetus. The beneficial effects of fluoride predominantly occur at the tooth surface, after the teeth have erupted.^{21–23} Accordingly, the Canadian Pediatric Society and the American Academy of Pediatrics advise against fluoride supplements during the first 6 months of life.²⁴

Exposure to fluoride comes from a variety of sources, but for people who live in cities with fluoridated water, the main source of ingestion is drinking water. Importantly, pregnant women and formula-fed babies may not be able to access nonfluoridated water.

CONCLUSION

Did our article shift the needle? Perhaps for those who are willing to integrate new knowledge with their existing beliefs. To understand why many questions about the safety of CWF are still not settled after 75 years, we need to recognize how entrenched beliefs can lead to biases and blind spots, even among highly trained clinicians and scientists. Science advances by continuously challenging old ideas and adjusting our beliefs as new knowledge emerges, even if this new evidence conflicts with conventional wisdom or is inconvenient.

Dr. Lanphear, a senior scientist on our team who conducted many of the pivotal lead toxicity studies that helped confirm Dr. Needleman's work, reminded us that it took two decades of research before the CDC declared, “there is no safe level of lead in children's blood”. Dr. Lanphear wrote, “The critics—who were often paid by industry or simply ignorant about lead toxicity but

still willing to offer their 'expert' opinion—delayed efforts to prevent lead poisoning by decades”.

We typically fret about subtle biases, like recall bias and unmeasured confounding, but confirmation bias, the tendency to ignore or debunk data that does not conform to what we believe, is arguably a much larger problem. Failure to act on consistent evidence that indicates safety risks could amount to enormous costs at the population level.

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ADDITIONAL INFORMATION

Competing interests: The authors declare no competing interests.

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July 16, 2020

RE: Clarification for the members of the Protection and Policy Committee of the City of Green Bay regarding the meeting on community fluoridation

Dear Chair Mark Steuer and Committee Members,

Dr. Johnny Johnson made **inaccurate comments in his testimony about the conclusions of our study** titled, *Association between Maternal Fluoride Exposure during Pregnancy and IQ Scores in Offspring in Canada*. This study, published in JAMA Pediatrics, was based on a prospective pregnancy and birth cohort from Canada.

We found that higher levels of fluoride in pregnant women and their drinking water were associated with a 3- to 5-point lower IQ score in their preschool aged children.

I am writing to clarify that my co-authors and I have recommended reducing fluoride intake during pregnancy. Some of my coauthors have recommended this reduction includes fluoridated water because water is the main source of fluoride for people who live in communities with fluoridation; one pointed out the need for more research before making specific recommendations for community water fluoridation.

Dr. Johnson said we should not change policy because of one or two new studies. Our recommendation to reduce fluoride intake during pregnancy is based on our findings, as well as those reported by others, showing similar findings. A 2019 systematic review on fluoride neurotoxicity by the National Toxicology Program concluded that "fluoride is presumed to be a cognitive neurodevelopmental hazard to humans". This report, which is still in draft form, underscores the consistency across the large number of human and animal studies.

We discuss the challenges of conducting fluoride research and some of the biases we have encountered in the attached commentary entitled: *The evolving science of fluoride: When new evidence doesn't conform with existing beliefs*.

Sincerely,

A handwritten signature in cursive script that reads "Christine Till".

Christine Till, PhD
Associate Professor
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York University, Toronto



Dr. Christine Till letter she had to send to members of the Green Bay City Council due to misinformation being spread by the American Fluoridation Society President Johnny Johnson.

A sampling of the scientific studies and reports compiled by Karen Spencer, relevant to water fluoridation, published since the HHS 2015 recommendation to lower the fluoridation target to 0.7 ppm is listed below.

I suggest these items provide compelling evidence that 0.7 ppm is neither optimal nor safe and that any claims to the contrary are ill-founded. Moreover, protests that more study is required before banning fluoridation is a tacit endorsement of human experimentation without individual consent which is medical assault - *Karen F. Spencer*

2022

RIGHT QUESTION: Given the robust and consistent evidence regarding the developmental neurotoxic impact of fluoridation policy, the question that needs to be evaluated by communities should be: is this intervention worth the risk of lowering the IQ of at least certain individuals when we have a viable substitute, i.e. fluoridated toothpastes?

<https://www.karger.com/Article/Abstract/520789>

- Vieira AR The Overlooked Individual: Susceptibility to Dental Caries, Erosive Tooth Wear and Amelogenesis. Monogr Oral Sci. Basel, Karger, 2022, vol 30, pp 140–148.

PAROTID GLANDS: Animal study finds fluoride exposure results in oxidative stress and changes in oxidative biochemistry of the largest salivary gland which stimulates compensatory mechanisms and increases risk to the complex cell cytoskeleton.

<https://www.ncbi.nlm.nih.gov/labs/pmc/articles/PMC8794182/>

- Miranda GHN, et al. Effects of long-term fluoride exposure are associated with oxidative biochemistry impairment and global proteomic modulation, but not genotoxicity, in parotid glands of mice. PLoS One. 2022 Jan 27;17(1):e0261252.

LOWER PERFORMANCE IQ: Examined children's IQ at three separate time points (age 4, 5, and 6–12 years) to determine longitudinal and domain specific effects of prenatal fluoride exposure on IQ in mother-child dyads from the Early Life Exposures in Mexico to Environmental Toxicants (ELEMENT) cohort. Found prenatal exposure to fluoride, which is primarily from fluoridated salt programs, is associated with sustained impacts on IQ. Non-verbal abilities may be more susceptible to impairment from prenatal fluoride exposure as compared to verbal abilities.

<https://www.sciencedirect.com/science/article/abs/pii/S0013935122003206?via%3Dihub>

- Goodman C, et al. Domain-specific effects of prenatal fluoride exposure on child IQ at 4, 5, and 6–12 years in the ELEMENT cohort. Environmental Research. 2022

GENOTOXIC: According to public health authorities, fluoride has a narrow range between the concentration which is beneficial and that which has adverse effects. The primary exposure to the fluoride-ion is through drinking water supplemented with fluorosilicic acid (FA). FA in 'safe' doses causes DNA damage in human osteoblast cells, reduces the telomere length and induces oxidative stress. Although combinations of fluoride with other toxins could have a synergistic effect, this study found that FA alone affects the genomic integrity of human bone cells.

<https://pubmed.ncbi.nlm.nih.gov/35483789/>

- Garcia ALH, Matzenbacher CA, Soares S, Rohr P, da Silva J. Fluorosilicic acid and cotinine, separately and in combination, induce genotoxicity and telomeric reduction in human osteoblast cell line MG63. *Mutat Res Genet Toxicol Environ Mutagen*. 2022 Apr-May;876-877:503474.

BODY & BRAIN: “Fluoride in higher concentrations or continuous exposure to lower doses are both found to induce mental imbalance in animals apart from the genotoxic, immunotoxic, and cytotoxic effects commonly observed. The behavioral profile of fluoride-treated animals has corroborated the clinical symptoms seen in fluoride-poisoned humans.”

<https://pubmed.ncbi.nlm.nih.gov/35488996/>

- Ottappilakkil H, Babu S, Balasubramanian S, Manoharan S, Perumal E. Fluoride Induced Neurobehavioral Impairments in Experimental Animals: a Brief Review. *Biol Trace Elem Res*. 2022 Apr 30.

PROBIOTICS: Adding probiotics to school milk is more effective and less costly than fluoride varnish in preventing cavities in children. <https://pubmed.ncbi.nlm.nih.gov/35567374/>

- Rodriguez GA, Cabello RA, Borroni CP, Palacio RA. Cost-effectiveness of probiotics and fluoride varnish in caries prevention in preschool children. *J Public Health Dent*. 2022 May 14.

OVARIAN & TESTICULAR: Animal study from in utero through puberty showing adverse impact on reproductive function. “Approximately 80–90% of fluoride absorbed by infants and children accumulates in the body. It can enter into the umbilical cord blood of the child from the mother through the placenta. In addition, significantly high fluoride content in breast milk is indicative of fluoride exposure to infants. Young children show less resistance to the toxic effects of fluoride than adults because of under-developed defense mechanisms and highly permeable blood-brain barrier.” <https://link.springer.com/article/10.1007/s12011-022-03220-8>

- Li, W., Sun, Z., Li, M. et al. Exposure to Fluoride From in Utero to Puberty Alters Gonadal Structure and Steroid Hormone Expression in Offspring Rats. *Biol Trace Elem Res* (2022).

BIRTH ANTHROPOMETRY: Using ELEMENT cohort, authors determined maternal exposure to fluoride affects length and weight of newborns with different susceptibility windows. Advises women avoid fluoride during pregnancy. <https://pubmed.ncbi.nlm.nih.gov/35660617/>

- Ortíz-García SG, Torres-Sánchez LE, Muñoz-Rocha TV, Mercado-García A, Peterson KE, Hu H, Osorio-Yáñez C, Téllez-Rojo MM. Maternal urinary fluoride during pregnancy and birth weight and length: Results from ELEMENT cohort study. *Sci Total Environ*. 2022 Jun 2:156459. PMID: 35660617.

KIDNEY KILLER: Using U.S. NHANES data, finds water fluoridation results in significantly higher plasma fluoride levels in healthy teens with lower renal function, suggesting a vicious feedback loop for those with CKD.

<https://www.sciencedirect.com/science/article/abs/pii/S0013935122009306>

- John Danziger, Laura E.Dodge, Howard Hu. Role of renal function in the association of drinking water fluoride and plasma fluoride among adolescents in the United States: NHANES, 2013–2016. Environmental Research. 7 June 2022.

SKELETAL FLUOROSIS: Summary of the adverse effects of ≤ 0.7 mg/L exposure on skeletal and non-skeletal systems finds “low fluoride can indeed cause damage to human health. As a consequence, it is necessary to formulate the more appropriate water fluoride standard by taking into account the effects of low fluoride on various bodily systems. In addition, more and more evidence suggest that there exist individual differences in the effect of low fluoride on the body... most likely due to genetic polymorphisms. Therefore, it is necessary to consider both environmental exposure and the actual genetic situation of the individuals with respect to fluoride exposure.”

<https://pubmed.ncbi.nlm.nih.gov/35661326/>

- Zhou J, Sun D, Wei W. Necessity to Pay Attention to the Effects of Low Fluoride on Human Health: an Overview of Skeletal and Non-skeletal Damages in Epidemiologic Investigations and Laboratory Studies. Biol Trace Elem Res. 2022 Jun 6.

NOT BENEFICIAL: Dental fluorosis (DF) is a qualitative defect in enamel from fluoride exposure early in life. DF is associated with other systemic conditions i.e. cognitive deficits, bone problems, thyroid disorders, etc. Significant incidences of DF are found in areas with 0.25 ppm fluoride in water concentration. Remineralization without fluoride exposure is advisable. <https://www.mdpi.com/1660-4601/19/12/7153/htm>

- Strużycka I, et al. Assessing Fluorosis Incidence in Areas with Low Fluoride Content in the Drinking Water, Fluorotic Enamel Architecture, and Composition Alterations. Int J Environ Res Public Health. 2022 Jun 10;19(12):7153.

2021

BENCHMARK DOSE ANALYSIS: Using fluoride studies from MIREC and ELEMENT projects as input, the results of which are consistent with other studies, authors identify 0.2 mg/L as having an adverse impact on neurodevelopment. “The prospective studies offer strong evidence of prenatal neurotoxicity, and the benchmark results should inspire a revision of water-fluoride recommendations aimed at protecting pregnant women and young children.”

<https://pubmed.ncbi.nlm.nih.gov/34101876/>

- Grandjean P, Hu H, Till C, Green R, Bashash M, Flora D, Tellez-Rojo MM, Song P, Lanphear B, Budtz-Jørgensen E. A Benchmark Dose Analysis for Maternal Pregnancy Urine-Fluoride and IQ in Children. Risk Analysis. 8 June 2021.

LIFETIME EXPOSURE: Fluoridation is the primary source of fluoride exposure for 1,629 Canadians between 3 and 79 that finds substantially higher lifetime fluoride exposure in fluoridated communities using CHMS data, increasing with age. Vulnerable subpopulations to adverse effects of fluoride noted as the young, those who are iodine deficient, and post-menopausal women. <https://www.mdpi.com/1660-4601/18/12/6203/htm>

- Julia K. Riddell, Ashley J. Malin, Hugh McCague, David B. Flora, and Christine Till. Urinary Fluoride Levels among Canadians with and without Community Water Fluoridation. Int. J. Environ. Res. Public Health 2021, 18(12), 6203.

KIDNEYS: This study of 1,070 adults found every 1 mg/L increment in the urinary fluoride concentrations was associated with significant increases of 22.8% in the risk of kidney function injury after adjusting for potential confounding factors. Authors conclude that long-term fluoride exposure is associated with compromised kidney function in adults, and that urinary NAG is a sensitive and robust marker of kidney dysfunction caused by fluoride exposure.

<https://pubmed.ncbi.nlm.nih.gov/34478979/>

- Wu L, Fan C, Zhang Z, Zhang X, et al. Association between fluoride exposure and kidney function in adults: A cross-sectional study based on endemic fluorosis area in China. *Ecotoxicol Environ Saf.* 2021 Aug 31;225:112735.

BEHAVIORAL CHANGES: Children in Cincinnati Childhood Allergy and Air Pollution Study (CCAAPS) assessed at age 12. Boys in particular did not experience significant anxiety or depression, yet had somatic behaviors based on their childhood urinary fluoride (CUF) concentrations, “seven times more likely to exhibit ‘at-risk’ internalizing symptomology.”

<https://pubmed.ncbi.nlm.nih.gov/34755609/>

- Adkins EA, Yolton K, Strawn JR, Lippert F, Ryan PH, Brunst KJ. Fluoride exposure during early adolescence and its association with internalizing symptoms. *Environ Res.* 2021 Oct 29:112296.

CRITICAL WINDOWS: Using urine samples and test scores from 596 mother-child Canadian pairs in the MIREC prospective cohort, researchers found evidence that developmental neurological damage was based on timing of fluoride exposure and gender, “Associations

between fluoride exposure and PIQ (performance IQ) differed based on timing of exposure. The prenatal window may be critical for boys, whereas infancy may be a critical window for girls.” <https://pubmed.ncbi.nlm.nih.gov/34051202/>

- Farmus L, Till C, Green R, Hornung R, Martinez-Mier EA, Ayotte P, Muckle G, Lanphear B, Flora D. Critical Windows of Fluoride Neurotoxicity in Canadian Children. *Environ Res.* 2021 May 26:111315.

GENES: Several genes make individuals more vulnerable to the neurotoxic impact with gender differences, also affecting mitochondria and suggesting vulnerability to dementia. Chinese study of 952 school children between 7 and 13 using water, urinary, hair and nail fluoride identified multiple neurodevelopmental metabolic pathways that result in adverse effects from low fluoride exposures.

<https://www.sciencedirect.com/science/article/pii/S0160412021003068>

- Yu X, Xia L, Zhang S, et al. Fluoride exposure and children's intelligence: Gene-environment interaction based on SNP-set, gene and pathway analysis, using a case-control design based on a cross-sectional study. *Environ Int.* 2021 Jun 4;155:106681.

GENETIC VULNERABILITY: Dopamine relative genes affect the susceptibility of individuals to fluoride toxicity even in safe water concentrations which result in lowered IQ so that “low-moderate fluoride exposure is inversely related to children’s IQ.”

<https://pubmed.ncbi.nlm.nih.gov/33360592/>

- Zhao L, Yu C, Lv J, et al. Fluoride exposure, dopamine relative gene polymorphism and intelligence: A cross-sectional study in China. *Ecotoxicology and Environmental Safety*. 2021 Feb;209:111826.

BRITTLE BONES: “In this cohort of postmenopausal women, the risk of fractures was increased in association with two separate indicators of fluoride exposure. Our findings are consistent with RCTs and suggest that high consumption of drinking water with a fluoride concentration of ~1 mg/L may increase both BMD (bone mineral density) and skeletal fragility in older women.” <https://pubmed.ncbi.nlm.nih.gov/33822648/>

- Helte E, Donat Vargas C, Kippler M, Wolk A, Michaëlsson K, Åkesson A. Fluoride in Drinking Water, Diet, and Urine in Relation to Bone Mineral Density and Fracture Incidence in Postmenopausal Women. *Environ Health Perspect*. 2021 Apr;129(4):47005.

OSTEOARTHRITIS: Identifies fluoride as an environmental chemical that has adverse effects on articular cartilage and osteoarthritis (OA) risk. “In full sample analysis, a 1 mg/L increase in UF (urinary fluoride) level was associated with a 27% higher risk of OA.”

<https://link.springer.com/article/10.1007/s12011-021-02937-2>

- Sowanou, A., Meng, X., Zhong, N. et al. Association Between Osteoarthritis and Water Fluoride Among Tongyu Residents, China, 2019: a Case–Control of Population-Based Study. *Biol Trace Elem Res* (2021).

NO BENEFIT FOR PRESCHOOLERS: Polish study finds ‘optimal’ fluoride concentrations in water provide no dental benefit. Dental caries experience depended on oral hygiene and diet.

<https://www.sciencedirect.com/science/article/abs/pii/S0946672X2100016X>

- Opydo-Szymaczek J, et al. Fluoride exposure and factors affecting dental caries in preschool children living in two areas with different natural levels of fluorides. *Journal of Trace Elements in Medicine and Biology*. Volume 65. 2021.

ALTERNATIVE: This systematic review and meta-analysis concludes that biomimetic hydroxyapatite-containing, fluoride-free oral care products are effective in reducing dental decay, especially in children without the risk of dental fluorosis and neurotoxicity inherent in topical use of fluoridated products.

<https://files.cdha.ca/profession/journal/2752.pdf>

- Hardy Limeback, BSc, PhD, DDS; Joachim Enax, Dr; Frederic Meyer, Dr. Biomimetic hydroxyapatite and caries prevention: a systematic review and meta-analysis. | *Can J Dent Hyg* 2021;55(3): 148-159.

AMERICAN KIDNEYS: Using U.S. NHANES data from two recent cycles, finds ‘optimal’ amounts of fluoridated water results in high incidence of uric acid in adolescents suggesting higher risk of kidney disease and other illnesses. Identifies dose-response trend in plasma fluoride of teens.

<https://www.sciencedirect.com/science/article/pii/S0147651320315074>

- Yudan Wei, Jianmin Zhu, Sara Ann Wetzstein. Plasma and water fluoride levels and hyperuricemia among adolescents: A cross-sectional study of a nationally representative sample of the United States for 2013–2016. *Ecotoxicology and Environmental Safety*. Volume 208. 15 January 2021.

TODDLERS: The Programming Research in Obesity, Growth, Environment and Social Stressors (PROGRESS) cohort included 948 mother-child pairs from Mexico City. Blinded testing of children between one and 24 months to examine associations between maternal fluoride intake from food and beverages during pregnancy and offspring neurodevelopment in this prospective and longitudinal study found, “higher exposure to fluoride from food and beverage consumption in pregnancy was associated with reduced cognitive outcome, but not with language and motor outcome in male offspring over the first two years of life.” https://fluoridealert.org/wp-content/uploads/cantoral-2021.final_.pdf

- Alejandra Cantoral, Martha M. Tellez-Rojo, Ashley J. Malin, Lourdes Schnaas d, Erika Osorio-Valencia, Adriana Mercadob, E. Angeles Martínez-Mier, Robert O. Wright, Christine Till. Dietary fluoride intake during pregnancy and neurodevelopment in toddlers: A prospective study in the progress cohort. *Neurotoxicology* 87 (2021) 86–93.

NO SAFE DOSE: Study of Mexican children and their mothers using measurements of urinary fluoride and water concentrations associated dental fluorosis and lowered IQ with fluoride dose consistent with findings of larger studies in other countries. Authors declare WHO fluoride guidelines are unsafe and hypothesize that 0.045 F- mg/day is a protective exposure <https://www.mdpi.com/1660-4601/18/21/11490/htm>

- Farías P, Estevez-García JA, Onofre-Pardo EN, Pérez-Humara ML, Rojas-Lima E, Álamo- Hernández U, Rocha-Amador DO. Fluoride Exposure through Different Drinking Water Sources in a Contaminated Basin in Guanajuato, Mexico: A Deterministic Human Health Risk Assessment. *International Journal of Environmental Research and Public Health*. 2021; 18(21):11490.

BABY BRAIN POISON: Exposure to fluoridated water (10 mg/L & 50 mg/L) beginning on the first day of pregnancy and continuing through the last day of breastfeeding shows chemical imbalances, cellular damage and changes in the hippocampus of Wistar rat offspring that would affect neurological development.

<https://pubmed.ncbi.nlm.nih.gov/33096359/>

- Ferreira MKM, Aragão WAB, Bittencourt LO, Puty B, Dionizio A, Souza MPC, Buzalaf MAR, de Oliveira EH, Crespo-Lopez ME, Lima RR. Fluoride exposure during pregnancy and lactation triggers oxidative stress and molecular changes in hippocampus of offspring rats. *Ecotoxicology and Environmental Safety*. 2021 Jan 15;208:111437.

BAD TEETH - BAD BRAIN: Chinese study confirm 1.6 ppm v. 0.1 ppm results in children with both damaged teeth and lower IQ. Authors validate that fluoride affects thyroid function, neurotransmitters and mitochondrial energy enzymes. There were no students with low IQ found in the area with low F level. There was high IQ among the 96.6% of the students who did not experience fluorosis.

<https://www.sciencedirect.com/science/article/pii/S0213911121001965>

- Yani SI, Seweng A, Mallongi A, et al. The influence of fluoride in drinking water on the incidence of fluorosis and intelligence of elementary school students in Palu City. *Gac Sanit*. 2021;35 Suppl 2:S159-S163.

GUTS & BRAINS: Memory function was reduced and gut microbiota structure was significantly altered in fluoride-exposed mice.

<https://www.sciencedirect.com/science/article/pii/S0147651321002190>

- Xin J, Wang H, Sun N, Bughio S, Zeng D, Li L, Wang Y, Khalique A, Zeng Y, Pan K, Jing B, Ma H, Bai Y, Ni X. Probiotic alleviate fluoride-induced memory impairment by reconstructing gut microbiota in mice. *Ecotoxicol Environ Saf.* 2021 Jun 1;215:112108

INFLAMED GUTS: Exposure to fluoridated water at both doses (10 mg/L & 50 mg/L) inflame guts in rats and alters the gut microbiome as compared to control (0 mg/L).

<https://pubmed.ncbi.nlm.nih.gov/33508686/>

- Dionizio A, Uyghurturk DA, Melo CGS, Sabino-Arias IT, Araujo TT, Ventura TMS, Perles JVCM, Zanoni JN, Den Besten P, Buzalaf MAR. Intestinal changes associated with fluoride exposure in rats: Integrative morphological, proteomic and microbiome analyses. *Chemosphere.* 2021 Jan 11;273:129607.

PUBERTY: Black girls consuming optimally fluoridated water have earlier menarche.

<https://doi.org/10.1007/s12403-021-00448-y>

- Malin, A.J., Busgang, S.A., Garcia, J.C. et al. Fluoride Exposure and Age of Menarche: Potential Differences Among Adolescent Girls and Women in the United States. *Expo Health* (2021).

HARMFUL ADEQUATE INTAKE (AI): Study found "the levels of dietary F- intake were below the current AI, were greater towards the end of gestation and in women who were moderately and highly compliant with Mexican dietary recommendation" in ELEMENT cohort and recommended changing future dietary recommendations due to evidence of developmental neurotoxicity at even low dose exposure. <https://pubmed.ncbi.nlm.nih.gov/33602354/>

- Castiblanco-Rubio, G., Muñoz-Rocha, T., Cantoral, A., Téllez-Rojo, M., Ettinger, A., Mercado-García, A., Peterson, K.E., Hu, H., Martínez-Mier, E. (2021). Dietary Fluoride Intake Over the Course of Pregnancy in Mexican Women. *Public Health Nutrition*, 1-25.

CALCIUM & FLUORIDE IN PREGNANCY: Calcium intake during pregnancy lowers urinary fluoride (UF) concentrations by some unknown mechanism in ELEMENT cohort.

<https://pubmed.ncbi.nlm.nih.gov/34176079/>

- Castiblanco-Rubio GA, Muñoz-Rocha TV, Téllez-Rojo MM, Ettinger AS, Mercado-García A, Peterson KE, Hu H, Cantoral A, Martínez-Mier EA. Dietary Influences on Urinary Fluoride over the Course of Pregnancy and at One-Year Postpartum. *Biol Trace Elem Res.* 2021 Jun 26.

SAFETY: Evidence of dental fluorosis and other adverse effects to bodies and brains from supposed safe concentrations is alarming. "The safety of public health approach of drinking water fluoridation for global dental caries reduction are urgently needed further research."

<https://www.sciencedirect.com/science/article/pii/S0147651321005510?via%3Dihub>

- Dong H, Yang X, Zhang S, Wang X, Guo C, Zhang X, Ma J, Niu P, Chen T. Associations of low level of fluoride exposure with dental fluorosis among U.S. children and adolescents, NHANES 2015-2016. *Ecotoxicol Environ Saf.* 2021 Jun 22;221:112439.

SKELETAL FLUOROSIS: This Chinese study of the pathogenetic progression of skeletal fluorosis, details how local signaling pathways, hormones, promoter DNA hypermethylation, RNA expression etc. are affected by fluoride exposure leading to pain and disability. <https://www.mdpi.com/1422-0067/22/21/11932/htm>

- Qiao L, Liu X, He Y, Zhang J, Huang H, Bian W, Chilufya MM, Zhao Y, Han J. Progress of Signaling Pathways, Stress Pathways and Epigenetics in the Pathogenesis of Skeletal Fluorosis. *International Journal of Molecular Sciences*. 2021; 22(21):11932.

DEPRESSION: Animal study finds negative changes in brain structure and behavior with exposure to sodium fluoride (NAF). <https://pubmed.ncbi.nlm.nih.gov/34735150/>

- Zhou G, Hu Y, Wang A, Guo M, Du Y, Gong Y, Ding L, Feng Z, Hou X, Xu K, Yu F, Li Z, Ba Y. Fluoride Stimulates Anxiety- and Depression-like Behaviors Associated with SIK2-CRTC1 Signaling Dysfunction. *J Agric Food Chem*. 2021 Nov 4. PMID: 34735150.

DECEPTION: This historical analysis documents how the ADA suppressed the established science that vitamin D was necessary for healthy teeth and bones in order to promote falsely fluoride which was and is more profitable for their membership. “Public health may well depend on looking at professional societies no different than the way we look at the pharmaceutical industry—conflicted organizations with a power to shape conventional wisdom based on fragile evidence.” <https://www.mdpi.com/2072-6643/13/12/4361/htm#>

- Hujoel PE. How a Nutritional Deficiency Became Treated with Fluoride. *Nutrients*. 2021.

2020

AMERICAN FETAL EXPOSURE: Study on pregnant women in California and Montana find, “Fluoride concentrations in urine, serum, and amniotic fluid from women were positively correlated to public records of community water fluoridation” and that concentration is consistent with findings of Canadian studies that find these concentrations are associated with increased learning disabilities and lower IQ in offspring.

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7132865/>

- Abduweli Uyghurturk D, Goin DE, Martinez-Mier EA, Woodruff TJ, DenBesten PK. Maternal and fetal exposures to fluoride during mid-gestation among pregnant women in northern California. *Environ Health*. 2020 Apr 6;19(1):38.

BLOOD: Canadian Health Measures Survey (CHMS) collects extensive biomonitoring data used to assess the exposure of Canadians to environmental chemicals finds higher fluoride in urine associated with significantly higher blood lead, urinary lead, etc. Also finds urinary selenium is significantly lower in fluoridated Canadian communities, “this is the first study where biomonitoring data from multiple cycles of CHMS were combined in order to generate robust estimates for subsets of the Canadian population. Such assessments can contribute to a regional-level prioritization of control measures to reduce the exposure of Canadians to chemicals in their environment.”

<https://www.ncbi.nlm.nih.gov/pubmed/31972364?dopt=Abstract>

- Valcke M, Karthikeyan S, Walker M, Gagné M, Copes R, St-Amand A. Regional variations in human chemical exposures in Canada: A case study using biomonitoring

data from the Canadian Health Measures Survey for the provinces of Quebec and Ontario. *Int J Hyg Environ Health*. 2020 Jan 20;225:113451.

THYROID & IQ: Concentrations of fluoride in drinking water considered optimal and safe in the US result in altered thyroid function and lowered IQ in Chinese children.

<https://www.sciencedirect.com/science/article/pii/S0160412019301370>

- Wang M, Liu L, Li H, et al. Thyroid function, intelligence, and low-moderate fluoride exposure among Chinese school-age children. *Environment International*. Volume 134, January 2020.

OVERDOSED CANADIAN BABIES: MIREC study documents Canadian bottle-fed babies have lower IQ in optimally fluoridated communities while breast fed babies have extremely low F and significantly higher IQ. <https://www.sciencedirect.com/science/article/pii/S0160412019326145>

- Till C, Green R, Flora D, Hornung R, Martinez-Miller EA, Blazer M, Farmus L, Ayotte P, Muckle G, Lanphear B. Fluoride exposure from infant formula and child IQ in a Canadian birth cohort. *Environment International*. 2020.

BIASED NARRATIVES: Canadian researchers comment on “expert” attacks on the high quality studies that contradict the dental CWF narrative, i.e. political suppression of scientific facts.

<https://www.nature.com/articles/s41390-020-0973-8>

- Till, C., Green, R. Controversy: The evolving science of fluoride: when new evidence doesn't conform with existing beliefs. *Pediatr Res* (2020).

BONE HEALTH: Low to moderate fluoride exposure weakens and damages bones in women.

<https://www.sciencedirect.com/science/article/abs/pii/S0147651320308708>

- Minghui Gao et al, Association between low-to-moderate fluoride exposure and bone mineral density in Chinese adults: Non-negligible role of RUNX2 promoter methylation. *Ecotoxicology and Environmental Safety*. Volume 203, 15 October 2020.

BONES: Found an age-specific association between fluoride exposure and altered CALCA methylation in adult women, affecting bone health.

<https://pubmed.ncbi.nlm.nih.gov/32283421/>

- Sun R, Zhou G, Liu L, Ren L, Xi Y, Zhu J, Huang H, Li Z, Li Y, Cheng X, Ba Y. Fluoride exposure and CALCA methylation is associated with the bone mineral density of Chinese women. *Chemosphere*. 2020 Aug;253:126616.

SEX HORMONES IN FLUORIDATED US: “The data indicated gender- and age-specific inverse associations of fluoride in plasma and water with sex steroid hormones of total testosterone, estradiol and SHBG in U.S. children and adolescents.”

<https://www.sciencedirect.com/science/article/pii/S0269749119357963>

- Bai, R., Huang, Y., Wang, F., & Guo, J. (2020). Associations of fluoride exposure with sex steroid hormones among U.S. children and adolescents, NHANES 2013–2016. *Environmental Pollution*, 114003

NERVOUS SYSTEM: The enteric nervous system (ENS) is called the second brain and governs the gastrointestinal track. Includes dopamine & serotonin function. Study finds “fluoride exposure during pregnancy and lactation might induce ENS developmental defects.”

<https://link.springer.com/article/10.1007/s12011-020-02249-x>

- Sarwar, S., Quadri, J.A., Kumar, M. et al. Apoptotic and Degenerative Changes in the Enteric Nervous System Following Exposure to Fluoride During Pre- and Post-natal Periods. Biol Trace Elem Res (2020).

ENDOCRINE SYSTEM REVIEW: The endocrine system includes the pineal gland, hypothalamus, pituitary gland, thyroid with parathyroid glands, thymus, pancreas (partial endocrine function), adrenal glands, as well as male and female gonads (testes and ovaries) which are adversely effected by exposure to fluoride.

<https://www.sciencedirect.com/science/article/abs/pii/S0045653520317604>

- Marta Skórka-Majewicz et al, Effect of fluoride on endocrine tissues and their secretory functions -- review. Chemosphere, Volume 260, December 2020, 127565.

PINEAL GLAND & MELATONIN: Fluoride calcifies the pineal gland and interferes with enzyme function, hormones and sleep patterns. <https://www.mdpi.com/2076-3417/10/8/2885>

- Dariusz Chlubek, Maciej Sikora. Fluoride and Pineal Glad. Applied Sciences. 22 April 2020.

WHO IGNORES KIDNEYS: WHO guidelines of safety below 1.5 ppm fluoride concentration is wrong. “The available guidelines for drinking water are solely based on healthy populations with normal renal function. But, it is evident that once the kidney function is impaired, patients enter a vicious cycle as fluoride gradually accumulates in the body, further damaging the kidney tissue.” <https://www.sciencedirect.com/science/article/abs/pii/S0045653520313795>

- Shanika Nanayakkara, et al. The Influence of fluoride on chronic kidney disease of uncertain aetiology (CKDu) in Sri Lanka. Chemosphere. Volume 257, October 2020, 127186

PEDIATRIC BONE DISEASE: Identifies fluoride concentrations in water above 1.2 ppm as “dangerously high” that can cause pediatric bone disease. Urine measurements of fluoride in those afflicted are below the fluoride concentrations in women living in optimally fluoridated communities per 2017 Canadian study by Green et al.

<https://pubmed.ncbi.nlm.nih.gov/32692054/>

- Nipith Charoenngam, Muhammet B Cevik, Michael F Holick. Diagnosis and management of pediatric metabolic bone diseases associated with skeletal fragility. Curr Opin Pediatr. 2020 Aug;32(4):560-573.

EPA ON ENVIRONMENTAL STRESS: EPA authors find that exposure to fluoride has the greatest adverse impact on cognitive ability in children, even more than lead.

<https://www.mdpi.com/1660-4601/17/15/5451/htm>

- Frances M. Nilsen, Jazmin D.C. Ruiz and Nicolle S. Tulve. A Meta-Analysis of Stressors from the Total Environment Associated with Children’s General Cognitive Ability. Int. J. Environ. Res. Public Health 2020, 17(15), 5451.

SOURCE: Compared MIREC, ELEMENT & PROGRESS data. MIREC & ELEMENT differed from PROGRESS in that “daily food and beverage fluoride intake was not associated with CUF in PROGRESS” but study “found that CUF (child urinary fluoride) levels are comparable among children in Mexico City and fluoridated Canadian communities, despite distinct sources of exposure.” <https://pubmed.ncbi.nlm.nih.gov/33233802/>

- Green, R., Till, C., Cantoral Preciado, A. D. J., Lanphear, B., Angeles Martinez-Mier, E., Ayotte, P., Wright, R. O., Tellez-Rojo, M. M., & Malin, A. J. (2020). Associations between urinary, dietary, and water fluoride concentrations among children in Mexico and Canada. *Toxics*, 8(4), 1-11. [110].

SPERM MOTILITY: Animal study determines mechanisms how fluoride exposure lowers sperm quality and male reproductive function. <https://pubmed.ncbi.nlm.nih.gov/31901658/>

- Liang C, He Y, Liu Y, Gao Y, Han Y, Li X, Zhao Y, Wang J, Zhang J. Fluoride exposure alters the ultra-structure of sperm flagellum via reducing key protein expressions in testis. *Chemosphere*. 2020 May;246:125772.

DENTAL FLUOROSIS & CWF CESSATION: Dental literature review by dentists finds “a significant decrease in the prevalence of fluorosis post cessation or reduction in the concentration of fluoride added to the water supply.”

<https://pubmed.ncbi.nlm.nih.gov/32598322/>

- Nor Azlida Mohd Nor, Kuala Lumpur, Barbara L. Chadwick, Damian JJ. Farnell, Ivor G. Chestnutt. The impact of stopping or reducing the level of fluoride in public water supplies on dental fluorosis: a systematic review. *Reviews on Environmental Health*. 2020.

2019

SLEEP & PINEAL GLAND: “Chronic low-level fluoride exposure may contribute to changes in sleep cycle regulation and sleep behaviors among older adolescents in the US.”

<https://ehjournal.biomedcentral.com/articles/10.1186/s12940-019-0546-7>

- Malin, A.J., Bose, S., Busgang, S.A. et al. Fluoride exposure and sleep patterns among older adolescents in the United States: a cross-sectional study of NHANES 2015–2016. *Environ Health* 18, 106 (2019)

ADHD: Youth in optimally fluoridated Canadian communities are almost 3 times more likely to be diagnosed with ADHD and have significantly higher rates of other learning disabilities as compared to their counterparts in non-fluoridated communities on a dose-response trend line. <https://www.sciencedirect.com/science/article/pii/S0160412019315971>

- Riddell JK, et al. Association of water fluoride and urinary fluoride concentrations with attention deficit hyperactivity disorder in Canadian youth. *Environment International*. Volume 133, Part B, December 2019.

ASD: Increased exposure to fluoride is associated with higher incidence of ASD in regions with fluoridated water or endemic fluorosis. Based on biological plausibility and incidence, authors hypothesize that increased fluoride exposure is an environmental risk factor for autism. <https://www.mdpi.com/1660-4601/16/18/3431/htm>

- Strunecka A, Strunecky O. Chronic Fluoride Exposure and the Risk of Autism Spectrum Disorder. *Int. J. Environ. Res. Public Health* 2019, 16(18), 3431.

PRENATAL: Three measurements in high quality NIH sponsored prospective cohort study (MIREC) found significantly lowered IQ in offspring of mostly white, well-educated Canadian women living in 'optimally' fluoridated communities.

<https://jamanetwork.com/journals/jamapediatrics/fullarticle/2748634>

- Green R, Lanphear B, Hornung R, et al. (2019) Association Between Maternal Fluoride Exposure During Pregnancy and IQ Scores in Offspring in Canada. *JAMA Pediatrics*. 2019.

KIDNEY & LIVER: Researchers at Mt. Sinai Medical School find American teens in optimally fluoridated American towns have markers for altered kidney & liver parameters that puts them at higher risk for kidney & liver disease as adults. Notes the primary source of fluoride is water.

<https://www.sciencedirect.com/science/article/pii/S0160412019309274>

- Malin AJ, Lesseur C, Busgang SA, Curtin P, Wright RO, Sanders AP. Fluoride exposure and kidney and liver function among adolescents in the United States: NHANES, 2013–2016. *Environment International*. August 8, 2019.

GUTS: Animal study on microbiome health and immunity documents fluoride causes serious damage to rectal structure and significantly inhibits proliferation of rectal epithelial cells.

<https://www.ncbi.nlm.nih.gov/pubmed/31885060/>

- Wang H., Miao C., Liu J. et al. Fluoride-induced rectal barrier damage and microflora disorder in mice. *Environ Sci Pollut Res* (2019).

TEETH: An analysis of the dental fluorosis data in three U.S. NHANES reports noted that more than half of American teens have fluoride damaged teeth as the result of too much fluoride consumption during childhood. This results in costly cosmetic dentistry in young adulthood for millions as well as increased decay in the more severely affected.

(20% very mild + 15% mild + 28% moderate + 3% severe = 65% afflicted per 2011-12 data) <http://fluoridealert.org/wp-content/uploads/neurath.2019-1.pdf>

- Neurath C, Limeback H, Osmunson Bm et al. (2019) Dental Fluorosis Trends in US Oral Health Surveys: 1986 to 2012. *JDR Clinical & Translational Research*.

ALZHEIMER'S: Even low concentrations of fluoride in drinking water at or below concentrations deemed optimal or safe by the WHO result in a pattern of increased dementia.

<https://www.ncbi.nlm.nih.gov/pubmed/30868981>

- Russ TC, Killin LOJ, Hannah J, Batty GD. Aluminium and fluoride in drinking water in relation to later dementia risk. *The British Journal of Psychology*. March 2019.

DNA DAMAGE: Mitochondrial dysfunction associated with dental fluorosis observed in Chinese children with fluoride concentrations in water identified as optimal or safe per U.S. authorities. Gender differences to the fluoride induced oxidative stress also noted.

<https://www.sciencedirect.com/science/article/pii/S0160412018326291?via%3Dihub>

- Zhou G, Yang L, Luo C, et al. Low-to-moderate fluoride exposure, relative mitochondrial DNA levels, and dental fluorosis in Chinese children. *Environment International*. Volume 127, June 2019, Pages 70-77.

DEMENTIA: Describes mechanism by which the effectiveness of the two most popular drugs used to treat Alzheimer's & other neurodegenerative dementia disease is reduced or blocked by fluoride. <https://www.mdpi.com/1660-4601/16/1/10/htm>

- Marta Goschorska, Izabela Gutowska, Irena Baranowska-Bosiacka, Katarzyna Piotrowska, Emilia Metryka, Krzysztof Safranow, Dariusz Chublek. Influence of Acetylcholinesterase Inhibitors Used in Alzheimer's Disease Treatment on the Activity of Antioxidant Enzymes and the Concentration of Glutathione in THP-1 Macrophages under Fluoride-Induced Oxidative Stress. *Int. J. Environ. Res. Public Health*, 2019, 16(1), 10.

ADULT BRAINS: First long term NaF animal study (10 weeks) using moderate levels of fluoride finds a number of histological changes including in parts of the brain associated with memory and learning. <https://www.sciencedirect.com/science/article/pii/S0045653518317508>

- Pei Jiang, Gongying Li, Xueyuan Zhou, Changshui Wang, Yi Qiao, Dehua Liao, Dongmei Shi. Chronic fluoride exposure induces neuronal apoptosis and impairs neurogenesis and synaptic plasticity: Role of GSK-3 β /b-catenin pathway. *Chemosphere*. Volume 214, January 2019, Pages 430-435.

DELAYED MALE PUBERTY: This 4th study from the NIH sponsored ELEMENT investigation of the prenatal impact of low-dose prenatal exposure found a significant pattern of delayed puberty for boys associated with maternal fluoride as measured in urine samples. Female data showed non-significant trend towards earlier menarche. More study needed to determine the impact on sexual development. <https://www.ncbi.nlm.nih.gov/pubmed/30922319>

- Liu Y, Téllez-Rojo M, Hu H, et al. Fluoride exposure and pubertal development in children living in Mexico City. *Environ Health*. 2019 Mar 29;18(1):26.

ANXIETY & DEPRESSION: Both rats and children experience changes in brain chemistry from extended exposure to fluoride which affects mood. Serotonin and the prefrontal cortex are impacted. Studies that only examine short-term exposure are inadequate to detect these changes which are more pronounced in females.

<https://www.sciencedirect.com/science/article/abs/pii/S0031938418309375>

- Lu F, Zhang Y, Trevedi A, et al. (2019) Fluoride related changes in behavioral outcomes may relate to increased serotonin. *Physiology & Behavior*.

EYE DISEASE: Fluoride is a poison that has biological impact on consumers in any dose, contributing to the development of cataracts, glaucoma and macular degeneration.

<https://www.mdpi.com/1660-4601/16/5/856>

- Waugh DT. The Contribution of Fluoride to the Pathogenesis of Eye Diseases: Molecular Mechanisms and Implications for Public Health. *Int. J. Environ. Res. Public Health*. 2019, 16(5), 856.

BONES & GENES: This 30 day animal study at 8 mg/L fluoride documents DNA & RNA damage that inhibits gene expression which can be passed on through generations affecting bone development and contributing to weak bones, blood & bone cancers and skeletal fluorosis.

<https://www.sciencedirect.com/science/article/pii/S0147651318311734?via%3Dihub>

- Atule P. Daiwile, Prashant Tarale, Saravanadevi Sivanesan, et al. Role of fluoride induced epigenetic alterations in the development of skeletal fluorosis. *Ecotoxicology and Environmental Safety*. Volume 169, March 2019, Pages 410-417.

BRAIN INJURY: Fluoride interferes with calcium metabolism which impacts brain chemistry and poisons the hippocampus. “The imbalance of calcium metabolism caused by fluorosis may be a pathogenesis of brain injury induced by fluoride.”

<https://www.sciencedirect.com/science/article/pii/S0045653518324007>

- Qiuli Yu, Dandan Shao, Rui Zhang, Wei Ouyang, Zigui Zhang. Effects of drinking water fluorosis on L-type calcium channel of hippocampal neurons in mice. *Chemosphere*. Volume 220, April 2019, Pages 169-175. [Online Ahead of Print]

BRAIN DAMAGE: Prenatal & postnatal animal experiment using 10, 50 and 100 mg/L to simulate human experience documents mitochondrial damage and neuronal death as mechanism that result in learning and memory impairments.

<https://www.ncbi.nlm.nih.gov/pubmed/30659323>

- Zhao, Q., Niu, Q., Chen, J. et al. Roles of mitochondrial fission inhibition in developmental fluoride neurotoxicity: mechanisms of action in vitro and associations with cognition in rats and children. *Arch Toxicol* (2019).

IODINE: Identifies and discusses the biochemical and hormonal impact of fluoride and fluoridation policy on iodine metabolism with consideration of related neurodevelopmental and pathological disorders. <https://www.mdpi.com/1660-4601/16/6/1086>

- Waugh DT. Fluoride Exposure Induces Inhibition of Sodium/Iodide Symporter (NIS) Contributing to Impaired Iodine Absorption and Iodine Deficiency: Molecular Mechanisms of Inhibition and Implications for Public Health. *Int. J. Environ. Res. Public Health* 2019, 16, 1086.

BIOLOGY OF POISON: Deep dive into the biological impact of fluoride that affects metabolism, hormones, immune function, etc. “Moreover, the findings of this study further suggest that there are windows of susceptibility over the life course where chronic F exposure in pregnancy and early infancy may impair Na⁺, K⁺-ATPase activity with both short- and long-term implications for disease and inequalities in health.” <https://www.mdpi.com/1660-4601/16/8/1427>

- Waugh DT. Fluoride Exposure Induces Inhibition of Sodium-and Potassium-Activated Adenosine Triphosphatase (Na⁺, K⁺-ATPase) Enzyme Activity: Molecular Mechanisms and Implications for Public Health. *Int. J. Environ. Res. Public Health* 2019, 16(8), 1427

DOSE RESPONSE: Three month study on adult rats found “fluoride can impair the learning ability of rats, which may be related to the induction of autophagy in rat hippocampal neurons.” <https://www.ncbi.nlm.nih.gov/pubmed/31111310>

- Zhang C, Huo S, Fan Y, Gao Y, Yang Y, Sun D. Autophagy May Be Involved in Fluoride- Induced Learning Impairment in Rats. Biol Trace Elem Res. 2019 May 20.

GENETIC SUSCEPTIBILITY: Review of recent scientific literature on biological impact. Same exposure in same population affect individuals differently, suggesting genetic vulnerability. <https://onlinelibrary.wiley.com/doi/full/10.1111/jcmm.14185>

- Wei, W, Pang, S, Sun, D. The pathogenesis of endemic fluorosis: Research progress in the last 5 years. J Cell Mol Med. 2019; 23: 2333– 2342.

MITOCHONDRIA: Prenatal and postnatal exposure to fluoride results in mitochondrial abnormalities, autophagy and apoptosis contributing to neuronal death.

<https://www.NCBI.nlm.nih.gov/pubmed/30659323>

- Zhao, Q., Niu, Q., Chen, J. et al. Roles of mitochondrial fission inhibition in developmental fluoride neurotoxicity: mechanisms of action in vitro and associations with cognition in rats and children. Arch Toxicol (2019).

NUTRITION: The f-ion is a poison but the bioavailability of CaF is different than NaF as calcium is the antidote to fluoride poisoning. In addition to being in water and dental products, 20% of pharma and 40% of agrichemicals have a fluoride base. Consequently, people are exposed to excessive amounts of fluoride which contributes to chronic disease.

<https://journals.matheo.si/index.php/ACSi/article/view/4932/2095>

- Stepec D, Ponikvar-Svet M. Fluoride in Human Health & Nutrition. Acta Chim Slov. 2019, 66.

SYNERGY, SUSCEPTIBILITY & TSCA: Accurately identifying highly exposed groups and the intrinsic and extrinsic factors that affect susceptibility require adequately assessing the aggregate exposure among vulnerable groups. The 2016 Lautenberg update to the 1976 Toxic Substance Control Act (TSCA) requires performing a challenging and scientifically disciplined risk assessment that mitigates risk, such as calculating the impact of combined fluoride exposure from fluoridated pesticides in food and fluoridated water on young children.

<https://www.ncbi.nlm.nih.gov/labs/pmc/articles/PMC6715167/>

- Koman PD, Singla V, Lam J, Woodruff TJ. Population susceptibility: A vital consideration in chemical risk evaluation under the Lautenberg Toxic Substances Control Act. PLoS Biol. 2019 Aug 29;17(8):e3000372.

2018

THYROID: 18% of people drinking 'optimally' fluoridated water in Canadian communities have a heightened risk of low thyroid function because fluoride interferes with iodine metabolism. Many of them will be sub-clinical and not know they are mildly hypothyroid, which nevertheless increases their risk for diabetes, high cholesterol, and other problems. Study

excluded those already diagnosed with thyroid disease. (CHMS)

<https://www.sciencedirect.com/science/article/pii/S016041201830833X>

- Ashley J. Malin, Julia Riddell, Hugh McCague, Christine Till. Fluoride exposure and thyroid function among adults living in Canada: Effect modification by iodine status. *Environment International*. Volume 121, Part 1, December 2018, Pages 667-674.

THYROID: Even 0.5 ppm fluoride in water has an adverse impact on thyroid hormones. Water is currently fluoridated to 0.7 ppm, a reduction from up to 1.2 ppm in 2015.

<https://www.NCBI.nlm.nih.gov/pmc/articles/PMC5805681/>

- Z. Kheradpisheh et al. (2018) Impact of Drinking Water Fluoride on Human Thyroid Hormones: A Case-Control Study. *Scientific Reports*. volume 8.

OVERDOSED BABIES: Over one third of babies (37%) in fluoridated American communities consume amounts of fluoride in excess of the upper limits of fluoride considered safe per government regulations. Even 4% of babies in non-fluoridated communities are overdosed on fluoride due to consumption of products made with fluoridated water. At the very least, this puts these children at high risk for developing dental fluorosis. Dental fluorosis is associated with increased incidence of learning disabilities, broken bones and kidney disease.

<http://jocpd.org/doi/10.17796/1053-4625-43.1.7>

- Claudia X Harriehausen, Fehmida Z Dosani, Brett T Chiquet, Michelle S Barratt, and Ryan L Quock. Fluoride Intake of Infants from Formula. *Journal of Clinical Pediatric Dentistry*. 2018.

GOVERNMENT BIAS: A National Toxicology Program animal experiment studying the impact of fluoride consumption used the wrong rats, the wrong dose, and the wrong study design in order to manufacture a finding of no prenatal or postnatal effect.

<https://www.sciencedirect.com/science/article/pii/S0306987718308600>

- Karen Favazza Spencer, Hardy Limeback. Blood is Thicker Than Water: Flaws in a National Toxicology Program Study. *Medical Hypotheses*. Volume 121. December 2018. Pages 160-163.

PREGNANT WOMEN: Pregnant Canadian women drinking 'optimally' fluoridated water had twice the fluoride exposure per individual testing as compared to pregnant women in non-fluoridated Canadian communities - and consistent with the range in the Mexican women in the ELEMENT cohort whose children had up to 6 points lowered IQ based on prenatal exposure to fluoride (from salt). The Canadian study excluded those with health conditions such as kidney disease as well as considered confounding factors such as tea consumption.

<https://ehp.niehs.nih.gov/doi/pdf/10.1289/EHP3546>

- Christine Till, Rivka Green, John G. Grundy, Richard Hornung, Raichel Neufeld, E. Angeles Martinez-Mier, Pierre Ayotte, Gina Muckle, and Bruce Lanphear. Community Water Fluoridation and Urinary Fluoride Concentrations in a National Sample of Pregnant Women in Canada. *Environmental Health Perspectives*. October 2018.

LEARNING DISABILITIES: Over 200 children were individually tested. Study found attention deficit disorder apparently caused by their prenatal exposure to fluoride specific to dose. This is the 3rd report out of the NIH sponsored 12 year ELEMENT project that has confirmed low

dose prenatal exposure to fluoride consistent with exposure in 'optimally' fluoridated communities causes subtle but permanent brain damage for many consumers. Excluded those with history of mental illness or conditions such as diabetes and renal disease.

<https://www.sciencedirect.com/science/article/pii/S0160412018311814>

- Morteza Bashash, Maelle Marchand, Howard Hu, Christine Till, Angeles Martinez-Mier, Brisa N. Sanchez, Niladri Basu, Karen Peterson, Rivka Green, Lourdes Schnaas, Adriana Mercado-García, Mauricio Hernández-Avila, Martha María Téllez-Rojo. Prenatal fluoride exposure and attention deficit hyperactivity disorder (ADHD) symptoms in children at 6– 12 years of age in Mexico City. *Environment International*. Volume 121, Part 1, December 2018, Pages 658-666.

ALZHEIMER'S DISEASE: Describes impact of fluoride-induced stress and inflammation in the development of Alzheimer's disease and demonstrates the mechanism for cell death in its worsening over time. <https://www.mdpi.com/1422-0067/19/12/3965>

- Goschorska M, et al. Potential Role of Fluoride in the Etiopathogenesis of Alzheimer's Disease. *Int. J. Mol. Sci.* 2018, 19 (12), 3965.

CANCER: Researchers who include an IARC scientist find esophageal cancer is 9.4 times more prevalent among those with dental fluorosis in the endemic fluorosis regions of Kenya. Provides biological plausibility that inflammatory fluoride affects microbiome and other biological mechanisms. Recommends more study. <https://www.ncbi.nlm.nih.gov/pubmed/30582155/>

- Menya D, Maina SK, Kibosia C, Kigen N, Oduor M, Some F, Chumba D3, Ayuo P, Middleton DR, Osano O, Abedi-Ardekani B, Schüz J, McCormack V. Dental fluorosis and oral health in the African Esophageal Cancer Corridor: Findings from the Kenya ESCCAPE case-control study and a pan-African perspective. *Int J Cancer*. 2018 Dec 23.

KIDNEYS: Fluoride is a common exposure that is selectively toxic to the kidneys.

<https://www.sciencedirect.com/science/article/pii/S0270929518301827>

- Lash LH. Environmental and Genetic Factors Influencing Kidney Toxicity. *Seminars in Nephrology*. Volume 39, Issue 2, March 2019, Pages 132-140.

IQ & DF: Between 0.5 and 3.9 mg/L, found every 0.1 mg/L increased dental fluorosis by 2.24% and every 0.5 mg/L decreases IQ by 2.67 points. Also found half as many kids with high IQ children with higher F- dose. <https://www.NCBI.nlm.nih.gov/pubmed/29870912>

- Yu X et al. Threshold effects of moderately excessive fluoride exposure on children's health: A potential association between dental fluorosis and loss of excellent intelligence. *Environ Int*. 2018 Jun 2;118:116-124.

WORSE THAN ARSENIC: "In conclusion, F exposure was related to the urinary excretion of early kidney injury biomarkers, supporting the hypothesis of the nephrotoxic role of F exposure." <https://www.sciencedirect.com/science/article/pii/S0041008X18302382>

- Monica I. Jiménez-Córdova, Mariana Cardenas-Gonzaleza, Guadalupe Aguilar-Madrid, Luz

C. Sanchez-Peña, Ángel Barrera-Hernández, Iván A. Domínguez-Guerrero, Carmen González-Horta, Olivier C. Barbier, Luz M. Del Razo. Evaluation of kidney injury biomarkers in an adult Mexican population environmentally exposed to fluoride and low arsenic levels. *Toxicology and Applied Pharmacology*. May 2018.

Brain-derived neurotrophic factor (BDNF): Chinese animal study verifies mechanisms using in vivo and in vitro methodology for cognitive deficits that “suggest that the developmental neurotoxicity of fluoride is associated with the impairment of synaptogenesis, which is caused by ERK1/2-mediated BDNF-TrkB signaling disruption.” BDNF is involved with learning, memory, aging and psychiatric disease <https://pubmed.ncbi.nlm.nih.gov/30130557/>

- Chen J, et al. ERK1/2-mediated disruption of BDNF-TrkB signaling causes synaptic impairment contributing to fluoride-induced developmental neurotoxicity. *Toxicology*. 2018 Dec 1;410:222-230.

KIDNEY CASCADE: “Taken together, these findings indicate that there can be some alterations in liver enzyme activities at early stages of fluoride intoxication followed by renal damage.” <https://pubmed.ncbi.nlm.nih.gov/29769014/>

- Perera T. et al. Effect of fluoride on major organs with the different time of exposure in rats. *Environmental Health and Preventive Medicine* (2018) 23:17

2017

REVIEW: Concludes that fluoridation schemes whether from water, food or salt programs “pose risks of various diseases in the asthmatic-skeletal, neurological, endocrine and skin systems. Dental and skeletal fluorosis are signs of chronic and excessive ingestion of fluoride.” <https://www.NCBI.nlm.nih.gov/pubmed/28453591>

- Verena Romero, Frances J. Norris, Juvenal A. Ríos, Isel Cortés, Andrea González, Leonardo Gaete, Andrei N. Tchernitchin. The impact of tap water fluoridation on human health. *Rev. méd. Chile* vol.145 no.2 Santiago Feb. 2017.

DOSE-RESPONSE: Validated that IQs of children are lowered on a dose-response trend line correlated with the amount of fluoride exposure as measured via urine tests of their mothers during pregnancy and individualized IQ tests of offspring. In the range consistent with doses in optimally fluoridated communities, there was up to a 6 point difference in IQ. This NIH sponsored 12 year longitudinal study conducted by researchers at world class American & Canadian universities excluded diabetics as well as those with kidney disease or pregnancy complications and allowed for many confounders. <https://pubmed.ncbi.nlm.nih.gov/28937959/>

- Morteza Bashash, Deena Thomas, Howard Hu, et al. Prenatal Fluoride Exposure and Cognitive Outcomes in Children at 4 and 6–12 Years of Age in Mexico. *Environ Health Perspect*. Sept 2017. Vol 125, Issue 9.

GENES & BONES: “This study provides evidence that chronic oxidative and inflammatory stress may be associated with the fluoride-induced impediment in osteoblast differentiation and bone development.” <http://link.springer.com/article/10.1007/s12011-016-0756-6>

- Gandhi, D., Naoghare, P.K., Bafana, A. et al. Fluoride-Induced Oxidative and Inflammatory Stress in Osteosarcoma Cells: Does It Affect Bone Development Pathway? Biol Trace Elem Res (2017) 175: 103.

PRESCHOOL DIET: Diet of two year olds contain unsafe levels of fluoride.

<http://onlinelibrary.wiley.com/doi/10.1111/cdoe.12283/full>

- Martinez-Mier EA, Spencer KL, Sanders BJ, Jones JE, Soto-Rojas AE, Tomlin AM, Vinson LA, Weddell JA, and Eckert GJ. Fluoride in the diet of 2-years-old children. Community Dent Oral Epidemiol. 2017;00:1–7.

APOPTOSIS: “Enamel fluorosis is a developmental disturbance caused by intake of supraoptimal levels of fluoride during early childhood. The enamel defects consist of horizontal thin white lines, opacities (subsurface porosities), discolorations, and pits of various sizes. The molecular mechanism underlying enamel fluorosis is still unknown..... We can hypothesize that fluorosis is due to a combination of direct cytotoxic effects causing cell death, the delayed development of tight junctions, which are necessary to form a sealed barrier between apical and basolateral surfaces, and a direct inhibitory effect of fluoride on vectorial calcium and/or bicarbonate transport.” <https://www.NCBI.nlm.nih.gov/pmc/articles/PMC5770627/>

- Rác, Róbert et al. “No Change in Bicarbonate Transport but Tight-Junction Formation Is Delayed by Fluoride in a Novel Ameloblast Model.” Frontiers in Physiology. 2017; 8: 940.

DNA: Finds that “prolonged fluoride intake at chosen concentrations caused imbalance of the cellular oxidative state, affected DNA and disrupted cellular homeostasis... It is recommended that fluoride supplementation requires a fresh consideration in light of the current study.”

<https://www.NCBI.nlm.nih.gov/pubmed/28089781>

- F.D. Campos-Pereira, L. Lopes-Aguiar, F.L. Renosto, et al. Genotoxic effect and rat hepatocyte death occurred after oxidative stress induction and antioxidant gene downregulation caused by long term fluoride exposure. Chem Biol Interact. 2017 Feb 25;264:25-33.

PRENATAL POISON: “F can pass through the cord blood and breast milk and may have deleterious impact on learning and memory of the mouse pups.”

<http://journals.sagepub.com/doi/abs/10.1177/0960327117693067>

- Y Zhang, X Xue, R Niu, J Wang. Maternal fluoride exposure during gestation and lactation decreased learning and memory ability, and glutamate receptor mRNA expressions of mouse pups. Z Sun, Human & Experimental Toxicology. February 13, 2017.

IMMUNITY: Prenatal and early postnatal exposure to fluoride impairs spleen function and development which damages spleen and lifelong immunity.

<https://www.NCBI.nlm.nih.gov/pubmed/28846973/>

- Yanqin Ma, Kankan Zhang, Fengjun Ren, Jundong Wang, Developmental fluoride exposure influenced rat's splenic development and cell cycle via disruption of the ERK signal pathway, In Chemosphere, Volume 187, 2017, Pages 173-180

NEUROINFLAMMATION: Toxic effects of fluoride on the central nervous system and immunity. <https://link.springer.com/article/10.1007/s10753-017-0556-y>

- Chen R, Zhao LD, Liu H. et al. Fluoride Induces Neuroinflammation and Alters Wnt Signaling Pathway in BV2 Microglial Cells. *Inflammation*. 2017;40: 1123.

2016

CRITIQUE HHS RECOMMENDATION: Pro-fluoridation team of dental researchers determined that the Department of Health and Human Services reduction of the optimal fluoride concentration to a single 0.7 ppm target is lacking in sound science, i.e. that “policy need to be cognizant of the balancing of risk and protective exposures across the entire population and potentially all ages and to be based on recent data that are purposefully collected, critically analyzed and carefully interpreted... (the recommendation seems) premature in terms of its rationale and its use and interpretation of sometimes dated data.” These authors’ bias is to maintain 1 ppm; nevertheless, their rationale against the HHS document is appropriate. The HHS document is political, not scientific.

<https://www.NCBI.nlm.nih.gov/pubmed/26710669>

- Spencer AJ, Do LG. Caution needed in altering the 'optimum' fluoride concentration in drinking water. *Community Dent Oral Epidemiol*. 2016 Apr;44(2):101-8.

OSTEOPOROSIS: “Consequently, although the World Health Organization continues to support F schemes for caries prevention despite a lack of scientific proof, the F schemes are not able to improve the crystal quality but rather contribute adversely to affect tooth development and increases the risk of developing postmenopausal osteoporosis.”

<http://dx.doi.org/10.4172/2379-1764.1000170>

- Mitsuo Kakei, Masayoshi Yoshikawa and Hiroyuki Mishima. Fluoride Exposure May Accelerate the Osteoporotic Change in Postmenopausal Women: Animal Model of Fluoride- induced Osteoporosis. *Adv Tech Biol Med* 2016, 4:1

DIABETES: Fluoridation policy significantly increases incidence of age related type 2 diabetes.

<https://www.NCBI.nlm.nih.gov/pubmed/27740551>

- K. Fluegge. Community water fluoridation predicts increase in age-adjusted incidence and prevalence of diabetes in 22 states from 2005 and 2010. *Journal of Water and Health*, 2016.

IBD: Crohn’s disease and ulcerative colitis increases after fluoridation begins in multiple countries. <http://www.NCBI.nlm.nih.gov/pubmed/27199224>

- Follin-Arbelet B, Moum B. Fluoride: a risk factor for inflammatory bowel disease? *Scand J Gastroenterol*. 2016 May 19:1-6.

PROPAGANDA: Assisted by the media, fluoridationists misrepresent historical and scientific fact in order to achieve a political end.

<https://www.researchgate.net/publication/305985332>

- Anat Gesser-Edelsburg and Yaffa Shir-Raz. Communicating risk for issues that involve 'uncertainty bias': what can the Israeli case of water fluoridation teach us? Journal of Risk Research. August 2016.

2015

COCHRANE CWF REVIEW: Estimates that 12% of the children living in fluoridated communities with 0.7 ppm fluoridation have aesthetically objectionable dental fluorosis with a total dental fluorosis effect of 40%. The effects were 47% & 15% for 1 ppm, only a minor impact on incidence of dental fluorosis and consistent with the findings of the 2000 York Review.

http://www.cochrane.org/CD010856/ORAL_water-fluoridation-to-prevent-tooth-decay

- Iheozor-Ejiofor Z, Worthington HV, Walsh T, O'Malley L, Clarkson JE, Macey R, Alam R, Tugwell P, Welch V, Glenny A. Water fluoridation for the prevention of dental caries. Cochrane Database of Systematic Reviews 2015, Issue 6.

THYROID: Diagnoses of low thyroid significantly higher in 'optimally' fluoridated regions.

<https://www.ncbi.nlm.nih.gov/pubmed/25714098>

- S Peckham, D Lowery, S Spencer. Are fluoride levels in drinking water associated with hypothyroidism prevalence in England? A large observational study of GP practice data and fluoride levels in drinking water. J Epidemiol Community Health. 24 February 2015.

ADHD: Researchers found between 67k and 131k more 11 year olds with ADHD in fluoridated regions of the U.S.

<http://www.ehjournal.net/content/pdf/s12940-015-0003-1.pdf>

- A Malin and C Till. Exposure to fluoridated water and attention deficit hyperactivity disorder prevalence. Environmental Health 2015, 14:17

CWF INFLAMMATIONS: Found that "even in small concentrations fluoride changes the amounts and activity of COX-1 and COX-2 enzymes taking part in the initiating and development of inflammatory process."

<http://www.sciencedirect.com/science/article/pii/S0887233315001605>

- I. Gutowska, et al. Fluoride as a factor initiating and potentiating inflammation in THP1 differentiated monocytes/macrophages. Toxicology in Vitro. Volume 29, Issue 7, October 2015, Pages 1661–1668.

NEUROTOXICANT: EPA scientists classify fluoride as a 'gold standard' developmental neurotoxicant with substantial evidence of harm.

<http://www.sciencedirect.com/science/article/pii/S0892036215300362>

- William R. Mundy, Stephanie Padilla, Joseph M. Breier, et al. Expanding the test set: Chemicals with potential to disrupt mammalian brain development. Neurotoxicology and Teratology. Volume 52, Part A, November–December 2015, Pages 25–35.

PROPAGANDIZING: The proponents of fluoridation ignored concerning evidence and did not deliver on their promise of dental benefit then, and now. Neither did they do the expected due diligence re harms. <https://doi.org/10.2105/AJPH.2015.302660>

- Carstairs C. (2015). Debating Water Fluoridation Before Dr. Strangelove. American journal of public health, 105(8), 1559–1569.

NOT COST EFFECTIVE: Reveals errors in cost-benefit analysis (CBA) used by CDC. Best case scenario after corrections is a \$3 benefit which is more than wiped out by any consideration of dental fluorosis. Fluoridated drinking water results in an economic loss to communities. <http://www.NCBI.nlm.nih.gov/pubmed/25471729>

- Lee Ko & Kathleen M. Thiessen (2015) A critique of recent economic evaluations of community water fluoridation, International Journal of Occupational and Environmental Health, 21:2, 91-120

Additional items of note:

2017 IAOMT Position Paper: <https://iaomt.org/iaomt-fluoride-position-paper-2/>

2018 Open Letter: <http://www.multibriefs.com/briefs/icim/nutrition.pdf>

2019 Children’s Health Defense Statement: <https://childrenshealthdefense.org/news/u-s-water-fluoridation-a-forced-experiment-that-needs-to-end/>

2020 Expert Opinion: <https://www.ehn.org/fluoride-and-childrens-health-2648120286.html>

“...fluoride is presumed to be a cognitive neurodevelopmental hazard to humans...”

- Draft Monograph from National Toxicology Program, [“Systematic Review of Fluoride Exposure and Neurodevelopmental and Cognitive Health Effects”](#) (Sept 6, 2019)

“The cessation of all compulsory water fluoridation schemes should be the goal of all public health agencies, ethical lawmakers, and informed citizens.”

- Prof. Rita F. Barnett-Rose, J.D. in [“Compulsory Water Fluoridation”](#) (2014)

DEFINITIONS:

- **Endorsement:** An endorsement is an authoritative statement reflecting a point of view for the purpose of exerting influence. An endorsement is *not* an expert opinion.
 - **Authoritative statement:** An opinion that interprets a rule, law or policy for the purpose of guiding, influencing, or mandating action. Authoritative statements are not inherently trustworthy or reliable, but they are inherently manipulative. “Testimonial propaganda” utilizes authoritative statements in marketing and in politics. The slogan “question authority” was intended to encourage critical thinking in order to combat the blind acceptance of biased

authoritative statements that endorse policy and/or sanctioned narratives. (*Logical Fallacies: Appeal to Authority*)

- **Expert Opinion:** An expert opinion is dependent on evidence and the due diligence of someone with substantial study in a field. The Daubert Standard is a legal process that validates the trustworthiness of experts offering opinion in a court of law.

EXAMPLES:

ENDORSEMENT: The April 2015 HHS statement recommending 0.7 ppm fluoride concentration in drinking water for 'safe & effective' prevention of tooth decay promoted the long standing fluoridation policy of the agency.

vs.

EXPERT OPINION: The June 2015 Cochrane report finds no reliable evidence of dental benefit to adults or low income children, but documents substantially higher rates of dental fluorosis, some of which will likely result in costly cosmetic dentistry. The 2019 National Toxicology Program systematic review offered an expert opinion based on the evidence that fluoride is a presumed hazard to human health specific to neurotoxic impact when exposure is pre- or post-natal.

The problem of fluoride causing permanent brain damage can easily be solved by simply turning off the fluoride dosing pumps at the water plant. This is the cheapest environmental justice issue to fix in the US. I hope that this action committee can act and force EPA and other agencies to do their job to protect human health and the environment. Thank you for your time and consideration of this important issue. I look forward to swift action on this issue because harmful fluoride is one EJ issue that the government is purposely forcing upon the population, and it costs nothing to turn off the dosing pumps.

Sincerely,

Brenda Staudenmaier

Members of the White House Environmental Justice Advisory Council,

Attached please find a letter providing the comments of the AMMD Pine Grove Project and the University of Virginia Environmental Law and Community Engagement Clinic on the need to account for the protection of sites of historic significance to environmental justice communities in developing the public performance scorecard. Federal law has often overlooked sites of historic significance to Black and Brown communities, as the AMMD Pine Grove Project has learned in its years-long battle to protect a historic black schoolhouse in Cumberland, Virginia.

The Pine Grove School opened in 1917 as part of the Rosenwald Schools initiative, a campaign spearheaded by Julius Rosenwald and Booker T. Washington. There was an acute need was to provide educational opportunities for African American children at a time when Jim Crow oppression barred them from attending public schools in the American South.

As a result of the AMMD Pine Grove Project's efforts, the school has earned a place on the National Register of Historic Places and the National Park Service's Preservation List of Most Endangered Historic Places. It is also listed in Virginia's Historic Register—the only one in its county listed for its connection to African American history. But the Pine Grove schoolhouse now faces a looming threat, one which environmental justice communities know all too well: a mega-landfill proposal on adjacent property.

We ask that the Advisory Council's scorecard be developed in a way that tracks the preservation status of crucial landmarks in the fight for environmental justice, like the historic Pine Grove School.

Respectfully,

Cale Jaffe

Professor of Law, General Faculty

Director, Environmental Law and Community Engagement Clinic

University of Virginia School of Law

August 3, 2022

**White House Environmental Justice Advisory Council
Virtual Public Meeting
August 3-4, 2022****RE: Comments of the AMMD Pine Grove Project to the White House Environmental Justice Council**

The Environmental Law and Community Engagement Clinic at the University of Virginia, on behalf of its client, the AMMD Pine Grove Project, appreciates this opportunity to submit comments on a proposed annual public performance scorecard to be developed by the White House Environmental Justice Advisory Council.

To cut to the chase, we request that in developing the scorecard, the Advisory Council pay particular attention to the protection of sites of historic significance to environmental justice communities. Protecting these sites from harm can be achieved through federal laws like the National Environmental Policy Act and the National Historic Preservation Act. But implementation of those laws has often overlooked sites of historic significance to Black and Brown communities, as the AMMD Pine Grove Project has learned in its years-long battle to protect a historic black schoolhouse in Cumberland, Virginia. The story of the Pine Grove School illustrates that without federal protection, sites of irrecoverable current and historic value can be lost—sites that planted the seeds of the contemporary environmental justice movement, and that continue to nurture it today.

The Pine Grove School opened in 1917 as part of the Rosenwald Schools initiative, a campaign spearheaded by Julius Rosenwald and Booker T. Washington. There was an acute need to provide educational opportunities for African American children at a time when Jim Crow oppression barred them from attending public schools in the American South. The Pine Grove Community raised a remarkable \$500 for the construction of the school in 1917. One family, the Millers, donated the land, and other families gave their own sweat and labor to build the school and maintain its grounds. For 47 years, until passage of the Civil Rights Act of 1964, the two-room schoolhouse remained in operation.

The effort to preserve the school was born a century later out of the work of the Agee, Miller, Mayo, and Dungy families, whose ancestral ties are deeply rooted in the historic Pine Grove School and the community that surrounds it. They founded the AMMD Pine Grove Project, an organization that now includes former Pine Grove students and current community members.

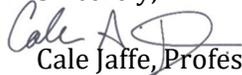
As a result of the AMMD Pine Grove Project's efforts, the school has earned a place on the National Register of Historic Places and the National Park Service's Preservation List of Most Endangered Historic Places. It is also listed in Virginia's Historic Register—the only one in its county listed for its connection to African American history. Recently, the Project secured funding from the National Parks Service for large-scale restorations.

But the Pine Grove schoolhouse faces a looming threat, one which environmental justice communities know all too well: a mega-landfill proposal on adjacent property. The landfill would dwarf the historic schoolhouse, bringing hundreds of diesel trucks rumbling up and down the road once walked by Pine Grove students—students like Muriel Branch, a leader of the Pine Grove Project.

The waste management company is seeking permits from the U.S. Army Corps of Engineers and the Virginia Department of Environmental Quality. The Pine Grove Project has requested that those pending permit applications be denied, and that an Environmental Impact Statement under the National Environmental Policy Act be completed before federal regulators approve any action. An Environmental Impact Statement would measure the likely impact of the project not just on the environment, but also on public health and historic and cultural resources. It would also require that alternatives sites be considered.

We ask that the Advisory Council's scorecard be developed in a way that tracks the preservation status of crucial landmarks in the fight for environmental justice, like the historic Pine Grove School. By prioritizing the preservation of sites of historic significance to environmental justice communities, the Advisory Council can honor those like the Pine Grove families, who have long fought against oppression.

Sincerely,



Cale Jaffe, Professor of Law
University of Virginia School of Law

cc: Sonja Branch-Wilson, AMMD Pine Grove Project
Muriel Miller Branch, AMMD Pine Grove Project

Environmental injustice was the term originally used to describe those communities that were adversely affected by harm to the environment in which they lived. Environmental justice suggests the optimism to correct those injustices and for this I am on board and hope to see more solutions.

My specific concern is the lack of water on Indian Reservations. Although I do not live on my reservation, the Tule River Indian Reservation in central California, I grew up there and most of my family still live there. I have also spent my career working with tribes throughout California and worked in Governor Brown's administration, which set many policies, provided funding and resources to address the lack of water and other environmental concerns on Indian land, due to the drought and caused by climate change.

I would like to see more federal law, regulation, policies and funding for Indian tribes to effectively address climate change. Given each tribe's sovereign status, the specific concern and solution should come from their leadership. I would like to see a forum from the top leadership of the tribes and federal government meet with the goal to actually provide real resources to address the short and long term needs. There should also be a report each year to show the progress and keep agencies accountable. This would take a commitment from the top.

Respectfully,

Cynthia Gomez

All:

The attached letter and my earlier September 9, 2021 letter and accompanying exhibits previously sent to all of you document in detail numerous egregious inaccuracies, unlawful excuses, and indefensible environmental justice abuses in EPA Region 9's January 28, 2022 and May 22, 2019 letters that coverup a gross lack of CERCLA remedial compliance and enforcement action by Region 9 at the federal Motorola 52nd Street (M52) National Priorities List (NPL) Superfund Site in Phoenix, Arizona.

This lack of CERCLA remedial compliance and enforcement action by EPA Region 9 has resulted in serious, decades-long unlawful groundwater contamination being allowed to unlawfully migrate uncontrolled from the federal M52 NPL Site and contaminate additional downgradient groundwater resources. More importantly, the unlawful migration of significant unlawful groundwater contamination for multiple decades beyond the boundary of the M52 NPL Site significantly contributes to ongoing and widespread public exposure of the local low income, dominantly minority community in this area to uncontrolled emissions of hazardous volatile organic compounds and other toxic chemicals from over 20 contaminated groundwater production wells that continue to operate in the area.

This unlawful groundwater contamination, unwarranted and unsafe human exposures to known carcinogenic and other toxic chemicals and the resulting environmental justice abuses are all caused, in significant part, by violations by EPA Region 9 of federal minimum environmental remedial action cleanup and human health exposure standards applicable under CERCLA to the federal M52 NPL Site. EPA Region 9's failure to act has allowed unlawful offsite migration of uncontrolled unlawful groundwater contamination from the M52 NPL Site to continue for decades despite express CERCLA legal remediation requirements to the contrary and express assurances by EPA Region 9 in a 1994 M52 NPL Site Record of Decision document to "fully address the threats posed by conditions at the [M52 NPL] site."

Due to EPA Region 9's failure and continued refusal to comply with and/or enforce applicable minimum CERCLA remedial action cleanup and human exposure standards at the federal M52 NPL Site, as clearly expressed in Region 9's January 28, 2022 and May 22, 2019 letters, we hereby request EPA Headquarters to independently review the documented information and data presented in the attached letter and my September 9, 2021 letter and accompanying exhibits. EPA Headquarters, especially with the Biden Administration's priority focus on remedial compliance and environmental justice, should not allow Region 9 to continue to neglect and coverup its decades-long history of insufficient remedial compliance and enforcement and failure to ensure equal protection of public health and the environment under CERCLA from the unlawful groundwater contamination and unsafe human exposures directly attributable to releases of hazardous and toxic substances within and from the federal M52 NPL Site in Phoenix, Arizona.

If EPA Headquarters and the Biden Administration are genuinely serious on focusing on CERCLA remedial compliance and environmental justice as top Administration priorities, there is no reason EPA Region 9 should be allowed to continue to ignore ongoing violations of CERCLA's applicable human exposure and groundwater remedial action cleanup standards at the federal M52 NPL Site, especially when those violations are directly responsible for decades-long unsafe exposure of a local minority community to numerous carcinogenic and other toxic chemicals at one of the largest groundwater contamination sites in the country.

We are ready to meet and discuss how this long-standing and inexcusable public tragedy can be readily addressed by simply requiring compliance and enforcement of the applicable CERCLA remedial action cleanup and human exposure standards and the Biden Administration's follow through on its numerous public commitments to environmental justice.

We look forward to hearing from you.

Sincerely,

David P. Kimball

June 9, 2022

VIA U.S. MAIL & EMAIL

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June 9, 2022

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DISEASE REGISTRY

Re: Motorola 52nd Street National Priorities List Site, Phoenix, Arizona

Dear Federal Officials:

I am in receipt of EPA Region 9's January 28, 2022 letter in response to my September 9, 2021 letter and accompanying exhibits and January 13, 2022 follow-up correspondence that was sent to all of you after more than four (4) months without any EPA response to my September 9, 2021 letter. After more than four (4) months of no response, Ms. Adams (as the Region 9 Director of the Superfund & Emergency Management Division) simply attached EPA Region 9's previous May 22, 2019 letter to her January 28, 2022 response under the false pretext that the May 22, 2019 EPA Region 9 letter "addresses the concerns raised again in [my] most recent correspondence." Ms. Adams' premise that EPA Region 9's May 22, 2019 correspondence is responsive to the serious environmental remedial action cleanup and human health exposure violations by EPA Region 9, as detailed in my September 9, 2021 letter and accompanying exhibits, is grossly misplaced and incorrect.

Contrary to EPA Region 9's self-serving and inaccurate statements in its May 22, 2019 letter, this letter and my September 9, 2021 letter and accompanying exhibits document serious, on-going unlawful groundwater contamination, unsafe human exposures and social injustice abuses directly caused by violations of applicable federal minimum remedial action cleanup and human health exposure standards under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) by EPA Region 9 at and relating to the federal Motorola 52nd Street (M52) National Priorities List (NPL) Site in Phoenix, Arizona. These violations within the federal M52 NPL Site directly and adversely impact the Arizona West Van Buren Area (WVBA) Water Quality Assurance Revolving Fund (WQARF) Site, which is a large Arizona groundwater contamination site directly adjacent to and hydrologically downgradient from the federal M52 NPL Site. The WQARF program is Arizona's equivalent to the federal CERCLA program.

G|K

My earlier letters and EPA Region 9's prior responses related to my requests for EPA assistance to continue, at that time, an active private voluntary groundwater pump and treat remediation approved by the Arizona Department of Environmental Quality (ADEQ) within the Arizona WVBA WQARF Site. That ADEQ-approved private wellhead groundwater remediation was voluntarily initiated to protect public health and the private groundwater supply wells that were impacted by unlawful groundwater contamination from releases of toxic chemicals by unrelated third parties. That ADEQ-approved private wellhead groundwater pump and treat remediation system cleaned up hazardous volatile organic compounds (VOCs) (as well as PFAS chemicals) in the contaminated groundwater to "at least ... Maximum Contaminant Level Goals established under the Safe Drinking Water Act" and "preclude[d] human exposure" to those hazardous substances beyond the operating wellhead treatment systems, as expressly required under the applicable Arizona aquifer water quality and WQARF groundwater remedial action standards.¹ The Arizona remedial action standards are consistent with the CERCLA minimum groundwater remedial action cleanup and human exposure standards in Section 121(d)(2)(A) and (B).² That private, voluntarily funded and operated wellhead groundwater pump and treat remediation system has since ceased operating after 8 years, due to EPA Region 9's failure under the Trump Administration to provide any requested assistance to continue that ADEQ-approved groundwater remediation within the Arizona WVBA WQARF Site.

As a result, and as thoroughly discussed in my September 9, 2021 letter and accompanying exhibits, groundwater contamination in violation of Arizona's applicable aquifer water quality standards and directly attributable to releases of hazardous substances within the geographical boundary of the hydrologically upgradient federal M52 NPL Site continues to be allowed by EPA Region 9 to unlawfully migrate uncontrolled downgradient into the WVBA WQARF Site and contaminant additional groundwater resources and be a continuing source of direct human exposure to numerous hazardous and toxic substances present in the contaminated groundwater. That unlawful groundwater contamination has been allowed by EPA Region 9 to unlawfully migrate uncontrolled for decades and continues to unlawfully migrate from the federal M52 NPL Site and, with the termination of the private voluntary downgradient wellhead groundwater pump and treat remediation system in the WVBA WQARF Site, is now continually being pumped without treatment by operating groundwater supply wells and released into the ambient air and open-air canals in the WVBA WQARF Site, directly exposing the local low income, dominantly minority community to hazardous VOCs, PFAS, 1, 4-Dioxane and other toxic chemicals. Such continuing unlawful migration of unlawful groundwater contamination and the unsafe human exposure to hazardous and toxic substances originating from releases within the federal M52 NPL Site are in direct violation of the minimum remedial action cleanup and human health exposure

¹ See, A.R.S. § 49-223.A ["Primary drinking water maximum contaminant levels [MCLs] established by the [EPA] administrator...are adopted as drinking water aquifer water quality standards."]; See also, A.R.S. §§ 49-224.B; 49-282.06.A.2 and 49-282.06.B.4.b; A.A.C. R18-16-406.I; A.A.C. R18-16-407.E.1. ADEQ also restricts the relocation or transfer of contaminants from one environmental media (groundwater) to another (air). See, letter from ADEQ Waste Programs Director to EPA Region 9 Superfund Director, dated November 14, 2007. These are all legally "applicable or relevant and appropriate" (ARAR) cleanup standards under CERCLA Section 121(d) for the federal M52 NPL Site.

² See, A.R.S. § 49-104.A.16 ["The department [ADEQ] shall, unless specifically authorized by the [Arizona] legislature, ensure state laws, rules, standards, permits, variances and orders are adopted and construed to be consistent with and no more stringent than the corresponding federal law that addresses the same subject matter."]

standards required under CERCLA Section 121(d)(2)(A) and (B) that legally apply to the federal M52 NPL Site.

The Biden Administration EPA should not, and cannot, hide behind the May 22, 2019 response and analysis prepared by EPA Region 9 of the Trump Administration that violate the CERCLA minimum remedial action cleanup and human health exposure standards applicable to the unlawful groundwater contamination originating within the federal M52 NPL Site. This is especially true now that EPA in April 2022 has issued its Equity Action Plan under EPA Executive Order (EO)13985 that commits the Biden Administration EPA to make “equity, environmental justice and civil rights a centerpiece of the agency’s mission.”³ “In practice, this means everyone enjoys the same degree of protection from environmental and health hazards.”⁴ In fact, EPA’s current top enforcement official in the Biden Administration recently pledged stepped-up enforcement actions to fully address such CERCLA non-compliance.⁵ Accordingly, EPA should pursue immediate active remedial cleanup and/or enforcement actions to prevent the historical and on-going violations of the applicable CERCLA groundwater remedial action and human health standards at the federal M52 NPL Site that are causing unsafe human exposure and disparate public health protection of the local minority community to numerous toxic chemicals.

In EPA Region 9’s May 22, 2019 letter, the Trump Administration made excuses that are in direct conflict with EPA’s April 2022 Equity Action Plan (EO 13985). More importantly, those EPA Region 9 excuses are all irrelevant to the minimum environmental remedial action cleanup and human health exposure standards required as a matter of federal law under CERCLA. These CERCLA standards legally apply to the unlawful groundwater contamination and toxic releases originating within the federal M52 NPL Site that have been and continue to be allowed by EPA Region 9 to unlawfully migrate uncontrolled downgradient and contaminate additional groundwater resources and be released and directly exposed to the local minority community in the WVBA WQARF Site.

My September 9, 2021 letter and accompanying exhibits didn’t ask for EPA assistance to continue the terminated private voluntary groundwater remediation system in the WVBA WQARF Site. Instead, my September 9, 2021 letter seeks active EPA remedial action and/or enforcement to address the unlawful groundwater contamination directly attributable to the federal M52 NPL Site as required under federal law. Section 121 (d)(2)(A) of CERCLA expressly requires:

“Such [CERCLA] remedial action shall require a level or standard of control which at least attains Maximum Contaminant Level Goals [MCLs] established under the Safe Drinking Water Act.”

Also, contrary to EPA Region 9’s May 22, 2019 letter, CERCLA’s minimum remedial action cleanup standards expressly preclude application of the Clean Water Act surface water quality criteria to the unlawful groundwater contamination that is being allowed to unlawfully

³ Executive Order 13985 Equity Action Plan; U.S. Environmental Protection Agency, April 2022, p.1.

⁴ Id. p.3.

⁵ Presentation by Larry Starfield, EPA Acting Enforcement Chief, American Bar Association, Washington D.C., May 24, 2022.

migrate uncontrolled from the federal M52 NPL Site and be directly exposed to the local minority community in the WVBA WQARF Site:

“[Surface] [w]ater quality criteria under the Clean Water Act ... may not be used to establish applicable standards under this paragraph if the process assumes a point of human exposure beyond the boundary of the facility ...”

The “no human exposure beyond the boundary of the facility” standard under CERCLA applies to the wellhead of a groundwater supply “well” that has been impacted by unlawful groundwater contamination that has been allowed by EPA Region 9 to unlawfully migrate from the federal M52 NPL Site. CERCLA defines the term “facility” to expressly include a “well” and expressly clarifies that the boundary of a site or facility placed on the CERCLA National Priority List (NPL), including the federal M52 NPL Site, “consists of all contaminated areas within the [geographic] area used to identify the site, as well as any other location where that contamination has [migrated and] come to be located.”⁶

In short, as a matter of federal law, CERCLA requires the unlawful groundwater contamination originating within and unlawfully migrating uncontrolled from the federal M52 NPL Site to be controlled and remediated “at least” to drinking water MCLs. Likewise, CERCLA expressly prohibits human exposure to the hazardous substances in the contaminated groundwater originating from the federal M52 NPL Site at any point beyond the boundary of any operating groundwater supply well impacted by the unlawful groundwater contamination from the federal M52 NPL Site if the hazardous substances in the groundwater have not been controlled and remediated “at least” to drinking water MCLs. Additionally, and as expressly committed to by EPA in its April 2022 Equity Action Plan (EO 13985), “equity, environmental justice and civil rights,” at a minimum, require compliance with these CERCLA minimum remedial action cleanup and human health exposure standards, especially for hazardous substances from sites like the federal M52 NPL Site that is considered one of the most contaminated sites in the country.

There is no excuse why EPA Region 9 for decades has not taken the minimum remedial actions expressly required under CERCLA to adequately control and treat the unlawful groundwater contamination and preclude any human exposure to the hazardous substances in the contaminated groundwater directly attributable to releases of hazardous substances within the federal M52 NPL Site that have been allowed to unlawfully migrate uncontrolled into the WBVA WQARF Site. This is the environmental injustice to the local minority community that is fully documented in my September 9, 2021 letter and accompanying exhibits. This is the environmental injustice that EPA Region 9 during the Trump Administration in its May 22, 2019 letter ignores, offering instead totally irrelevant and unlawful excuses to try and coverup decades of EPA Region 9 failure to comply with the CERCLA minimum remedial action cleanup and human health exposure standards applicable to the federal M52 NPL Site. This is the environmental injustice

⁶ CERCLA Section 101(9); 42 USC § 9601 (9) (The term “facility means (A) any building, structure, installation, equipment, pipe or pipeline ... well, pit, pond, lagoon, impoundment, ditch, landfill, storage container, motor vehicle, rolling stock, or aircraft, or (B) any site or area where a hazardous substance has been deposited, stored, disposed of, or placed, or otherwise come to be located...,” including contaminated groundwater extraction wells). See also, 83 Fed.Reg. 2549, 2551 (2018); 85 Fed.Reg. 54931, 54932 (2020).

that the Biden Administration's EPA has pledged to address in its April 2022 Equity Action Plan (EO 13985), and the environmental-injustice violations that EPA's current chief enforcement official has recently committed to take enforcement action against.

By continuing not to comply with or enforce the CERCLA minimum remedial action cleanup and human health exposure standards applicable to the unlawful groundwater contamination originating within the federal M52 NPL Site, we can only presume that EPA Region 9 in its January 28, 2022 and May 22, 2019 letters is acting knowingly and intentionally. EPA Region 9 is knowingly and intentionally refusing to apply the same and equally applicable CERCLA minimum remedial action cleanup and human health exposure standards to the unlawful groundwater contamination and released hazardous substances that EPA Region 9 has allowed to unlawfully migrate uncontrolled beyond the current geographical boundary of the federal M52 NPL Site and are now being released and directly exposed to the local minority community in the WVBA WQARF Site. Such continued unlawful inaction by EPA Region 9 clearly fails to provide "the same degree of protection from environmental and health hazards" to the minority community in the WVBA WQARF Site that the Biden Administration's EPA pledges in its April 2022 Equity Action Plan (EO 13985) to make "a centerpiece of the agency's mission" and to take aggressive actions to enforce.

EPA Region 9 tries to justify its disparate application and enforcement of the CERCLA remedial action cleanup and human health exposure standards applicable to the unlawful groundwater contamination and released hazardous substances that have been allowed by EPA Region 9 to unlawfully migrate uncontrolled from the federal M52 NPL Site into the WVBA WQARF Site by minimizing and downplaying the presumed human health exposure risk to the downgradient local minority community in the WVBA WQARF Site. First, note EPA Region 9 doesn't dispute that the local minority community is being continually and directly exposed to releases of known carcinogenic and other toxic substances despite the applicable "no human exposure" CERCLA remedial action cleanup standard if the hazardous substances in the unlawful groundwater contamination have not been controlled and treated to "at least" drinking water MCLs. EPA Region 9 also tries to deflect attention away from EPA Region 9's decades-long failure to fully comply with the CERCLA minimum "drinking water MCL" and "no human exposure beyond the boundary of the facility" remedial action cleanup standards applicable to the federal M52 NPL Site. EPA Region 9 does this by arguing "no one is drinking groundwater" in the WVBA WQARF Site and the ongoing releases of hazardous and toxic substances originating from the federal M52 NPL Site to the ambient air and open-air canals from numerous operating groundwater supply wells in the WVBA WQARF Site are "not impacting human health at levels of concern" or "do not pose an acute risk to public health."

First and importantly, these so-called, risk-based arguments by EPA Region 9 are irrelevant to the CERCLA minimum groundwater remedial action cleanup and human health exposure standards applicable to the unlawful groundwater contamination and releases of hazardous substances within the federal M52 NPL Site. The minimum CERCLA remedial action cleanup standards specifically require "a level or standard of control which at least attains Maximum Contaminant Level Goals established under the Safe Drinking Water Act" and no "point of human

exposure beyond the boundary of the facility.” More importantly, the local minority community in the WVBA WQARF Site that is being subjected to unlawful and unsafe exposures to hazardous and toxic substances originating from the federal M52 NPL Site has never agreed that the level of unlawful groundwater contamination and toxic exposure to which it has been and continues to be exposed is of “no concern” or that the 40-plus years of “chronic” exposure to known carcinogenic and other toxic chemicals is acceptable as long as the exposure is not “acute.” The WVBA WQARF Site is not like any other VOC-contaminated site in Arizona (or Region 9 in all likelihood) in that the local minority community has been exposed to uncontrolled hazardous VOC emissions from more than 20 contaminated Roosevelt Irrigation District (RID) groundwater supply wells for at least the past 40 years. Over 3,000 pounds of hazardous VOCs discharge into the ambient air and open-air canals of this minority neighborhood every year.

Under CERCLA’s applicable minimum remedial action cleanup standards, EPA Region 9 should have controlled migration from the federal M52 NPL Site of the hazardous VOCs, PFAS and other toxic substances in the unlawful groundwater contamination, treated the unlawful groundwater contamination from the federal M52 NPL Site to at least the applicable drinking water MCLs, and precluded any human exposure to the hazardous substances in the unlawful groundwater contamination that has migrated from the federal M52 NPL Site. The environmental injustice suffered by the local minority community in Phoenix, Arizona as a result of EPA Region 9’s failure to act, control and treat the unlawful groundwater contamination originating within and unlawfully migrating uncontrolled from the federal M52 NPL Site as required under CERCLA is demonstrably manifest by EPA Region 9’s disparate treatment under CERCLA of the same unlawful groundwater contamination within the geographical boundaries of Operating Units (OU) 1 and 2 of the federal M52 NPL Site.

Despite the undisputed facts that “no one [has or] is drinking the [contaminated] groundwater” and there has never been any point of human exposure to the hazardous and toxic substances in the contaminated groundwater within the geographical boundaries of the federal M52 NPL Site, both EPA and ADEQ determined that “actual or threatened releases of hazardous substances from this [federal M52 NPL] site, if not addressed by implementing the [pump and treat] response action selected in the ROD, may present an imminent and substantial endangerment to public health, welfare or the environment.”⁷ Based on this determination by EPA and ADEQ regarding the unlawful groundwater contamination solely within the boundaries of the federal M52 NPL Site, EPA Region 9, for more than 2 decades now, has required groundwater pump and treatment to restore the aquifer to its applicable MCL drinking water aquifer water quality standards and air-emission controls to preclude any human exposure to the hazardous substances present in the contaminated groundwater at OU1 and OU2 of the federal M52 NPL Site since 1992 and 2001, respectively, as expressly required under the applicable CERCLA minimum remedial action cleanup standards.

Yet, EPA Region 9 now wants us to accept in its May 22, 2019 letter that no CERCLA remediation is necessary for the WVBA WQARF Site, where for multiple decades there is

⁷ EPA Superfund Record of Decision: Motorola 52nd Street, Phoenix, Arizona, July 2, 1994, page 1.

documented unlawful groundwater contamination above applicable Arizona aquifer water quality standards and unsafe direct human exposure above EPA established not-to-be-exceeded air exposure levels to the very same hazardous and toxic substances originating from releases to groundwater within the federal M52 NPL Site that have been allowed by EPA Region 9 to unlawfully migrate uncontrolled into the WVBA WQARF Site. These are the same hazardous and toxic substances whose mere presence within the federal M52 NPL Site, without any human exposure, EPA and ADEQ determined more than 25 years ago present “an imminent and substantial endangerment to public health, welfare or the environment” requiring active CERCLA pump and treat remedial action at OU1 and OU2 of the M52 NPL Site.

Equally disturbing and unjustified is that, after extending the geographical boundary of the federal M52 NPL Site in 1997 to include the large OU3 area downgradient of OU2 to address the “co-mingling of regional VOC [groundwater] plumes”⁸ containing the same VOC and other toxic chemicals found in OU1 and OU2 in concentrations that violate Arizona’s applicable aquifer water quality standards, EPA Region 9 for more than 25 years now has failed to initiate any active remedial actions to comply with CERCLA’s minimum remedial action cleanup standards at OU3. Such EPA Region 9 inaction effectively has allowed the unlawful and unsafe hazardous and toxic substances in the contaminated groundwater within the identified boundary of the federal M52 NPL Site, specifically from OU3, to continue to unlawfully migrate uncontrolled and contaminate additional downgradient groundwater resources and be released and directly exposed to the local minority community in the WVBA WQARF Site.

Furthermore, the health assessments referenced by EPA Region 9 are flawed and inaccurate because they don’t take into account the legally applicable drinking water MCL aquifer water quality standards in Arizona, the increased toxicity established by EPA and adopted by the U.S. Department of Health and Human Services for trichloroethene (TCE) (a known carcinogen and only one of the many hazardous VOCs migrating from the federal M52 NPL Site) or acknowledge that the air samples taken back in 2011 in the breathing zone where the public may be exposed near the operating RID groundwater supply wells consistently exceeded the not-to-be-exceeded air exposure level established by EPA in Region 10 for TCE of 2.0 micrograms per cubic meter (ug/m^3). Importantly, a TCE concentration of 29.0 ug/m^3 was measured in ambient air near neighborhood homes at one of the RID wells during the 2011 sampling activity. In addition to excessive and unsafe concentrations of carcinogenic VOCs, other toxic chemicals in the contaminated groundwater migrating from the federal M52 NPL Site, including PFAS and 1–4, Dioxane, are being released into the minority community.

We sincerely request that EPA Headquarters independently review the documented information and data presented here and in the September 9, 2021 letter and accompanying exhibits and not allow Region 9 to continue to neglect and coverup its multi-decades history of remedial non-compliance and failure to ensure equal protection of human health and the environment under CERCLA from the unlawful groundwater contamination directly attributable and traceable to the federal M52 NPL Site in Phoenix, Arizona.

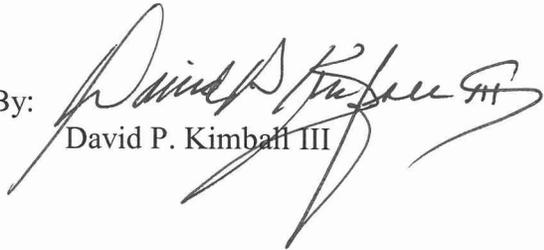
⁸ 2011 CERCLA Sitewide Five-Year Review Report, Motorola 52nd Street Superfund Site, Arizona Department of Environmental Quality, p. 17

If EPA Headquarters refuses to investigate the violations of CERCLA's minimum remedial action cleanup and human health exposure standards and resultant environmental injustices directly attributable to those CERCLA violations at the federal M52 NPL site, we will seek appropriate investigations by EPA's External Civil Rights Compliance Office and the Justice Department for violations by EPA Region 9 of the legally applicable CERCLA cleanup standards, the Civil Rights Acts and President Biden's Environmental Justice Executive Order with respect to the federal M52 NPL Site.

We are anxious to meet at your earliest convenience to discuss how this long-standing public tragedy can be resolved.

Very truly yours,

GALLAGHER & KENNEDY, P.A.

By: 
David P. Kimball III

DPK:lm

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Laura Malone, *ADEQ Division Director*
Mark Brnovich, *Arizona Attorney General*
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Senator Rosanna Gabaldon, LD2
Senator Majority Leader Rick Gray, LD21
Senator Assistant Minority Leader Lupe Contreras, LD19
Senator Lisa Otondo, LD4
Senator Martin Quezada, LD29
Senator Rebecca Rios, LD27
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House Rep. Minority Whip Domingo DeGrazia, LD10
House Rep. Richard Andrade, LD29
House Minority Leader Reginald Bolding, LD27
House Rep. Cesar Chavez, LD29
House Rep. Diego Espinoza, LD19
House Rep. Diego Rodriguez, LD27
House Rep. Athena Salman, LD26
House Rep. Lorenzo Sierra, LD19
House Rep. Raquel Terán, LD30
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Organization: Atlantic Climate Justice Alliance

General Comment

My name is Deanee Rios Co-Founder and Executive Director from Atlantic Climate Justice Alliance and Climate Reality Project Leader of NYC Chapter. We cover all the Atlantic Coast including Puerto Rico. As in general we have to change our ways of life and give participation to the Hispanic Community. There's so little information and mobilization of this important group of people and get them to participate in communities meetings. Because of the language barrier These are the people for Why Justice 40 was created There should be material and tool kits in Spanish.

In New York the cause of high pollution are the buildings. To help get rid of that it is to become all electric by 2030 for that to happen they should create some initiatives for heating and cooling and change to electric stoves. Also if you buy an electric car there is not sufficient places to recharge. There should be a tax exceptions for people to do the transition starting with communities solar grid. Con Ed should be going Offshore Wind Powered.

Also all these initiatives should include Puerto Rico. The Island is having Power Problems and money and programs should be advocated to go Off shore Wind or solar instead of repairing the old grid. This is the time of transition but new jobs will be created, and training should be accessible to fossil fuel workers in all categories

November 24, 2021

The Honorable Jessica Rosenworcel, Commissioner
Acting Chairwoman
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Dear Chairwoman Rosenworcel,

We write to you as scientists and public health experts deeply committed to protecting public health and the environment. As authors of numerous publications and reports in the field we urge that the FCC ensure a robust review of the latest science and expert recommendations in the FCC's upcoming reexamination of its Inquiry on human exposure limits for wireless radiation. The major scientific developments of the last two years must be included in the FCC review- especially in the new 5G environment where wireless is ubiquitous.

We request the FCC reopen Docket #13-84 "Reassessment of FCC Radiofrequency Exposure Limits and Policies" and Docket #03-137 "Proposed Changes to the Commission Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields" in order to refresh the record before issuing a final response to the recent August 13, 2021 [judgment](#) by the U.S. Court of Appeals for the District of Columbia Circuit, in *Environmental Health Trust et al. v. the FCC*.

Furthermore, as the FCC does not have expertise in interpreting scientific studies, it relies on input from federal health agencies and knowledgeable expert organizations to evaluate the scientific evidence and the adequacy of FCC limits. However the relevant US health and safety agencies have not reviewed the research on impacts to flora and fauna; long-term exposures from cell towers; children's unique vulnerability; and health effects such as damage to the brain and reproduction. The court noted that the "silence" of federal agencies such as the National Cancer Institute, the Environmental Protection Agency, the Centers for Disease Control and Prevention, and the National Institute for Occupational Safety and Health does not mean these agencies agree with the FCC's 1996 limits. In fact, none of these agencies has systematically reviewed the totality of science in their respective area of expertise both to develop safety standards and to offer an analysis of the adequacy of FCC's 1996 wireless exposure limits.

Accordingly, we recommend that the FCC record be reopened with ample time to allow for new substantive comments. U.S. safety limits for cell phones and cell towers must rest on sound science to ensure the public and wildlife are protected.

Importantly, we also recommend a full environmental impact review to evaluate 5G and the rapid proliferation of 4G wireless antennas in the USA. A [three part review](#) published in *Reviews in Environmental Health* found the scientific evidence showing adverse effects is sufficient to trigger new regulatory action to protect wildlife, yet the US does not have regulations that were ever designed to protect flora and fauna (1). Instead, the FCC is fast tracking small cell deployment and opening new

spectrum disregarding recent research which finds, for example, that the higher frequencies of 5G can result in higher absorption rates into the bodies of pollinators.

In addition, experts are warning that 5G will contribute to climate change and have [documented](#) the exponentially increasing energy demands of 5G networks, “smart” wireless devices, and other new communication technologies. As the FCC has projected hundreds of thousands of new wireless facilities, we recommend a full environmental assessment for the 5G rollout and 4G wireless network densification.

The [scientific evidence](#) has substantially increased over the last two years (2). In 2020 scientists of the National Institute of Environmental Health Sciences National Toxicology Program published their animal-study findings of “significant increases in DNA damage” in groups of mice and rats after just 14 to 19 weeks of exposure to cell phone radiation (3). A 2021 [analysis](#) published by the Environmental Working Group concluded FCC limits should be 200 to 400 times more protective than the whole-body exposure limit set by the FCC in 1996 (4). Unaware of the scientists calling for caution, school districts nationwide are deploying high-capacity Wi-Fi networks in school buildings, testing out 5G networks with students, and signing leases with companies to install cell towers on school property, relying on these outdated FCC limits. As the American Academy of Pediatrics and numerous other specialists [have noted](#), children are [uniquely vulnerable](#) to wireless radiation (5).

Health risks should be assessed by experts with no conflicts of interest. The FCC should not rely on the International Commission on Non-Ionizing Radiation Protection (ICNIRP), a small 14 member privately constituted invite only Commission lacking in transparency whose self-appointed membership has conflicts of interest and industry ties (6). ICNIRP has rejected the NTP and Ramazzini Institute animal studies with unfounded criticisms (7). Further, ICNIRP has not shown any systematic review of the totality of the research such as impacts to the developing brain and damage to reproduction. It has never conducted a comprehensive evaluation of human health and environmental risks associated with RF radiation. Their exposure guidelines are based solely on protecting against heating effects, with no change of concept since 1998, two years after the FCC adopted human exposure guidelines in 1996.

Broadband internet provides the connectivity that enables Americans to do their jobs, to participate equally in school learning and health care, and to create a fairer playing field by eliminating the digital divide. The United States must bridge the digital divide with a “future-proof” broadband infrastructure with wired *rather than wireless* connections to and through homes, schools and businesses that is affordable, reliable, high-speed, and sustainable.

Wherever possible, we urge that the broadband system rely on wired connections, rather than wireless connections. Wired connections are safer, faster, more secure, more energy efficient, and more reliable. Wired connections are especially important for schools and other institutions where they will save money and reduce exposure to wireless radiation.

Our experts stand ready to provide more detailed information to you on this important issue, including elaborating on materials and assistance with evaluating the science and impacts on humans, climate, animals, and wilderness.

Sincerely,

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5. [American Academy of Pediatrics Letter to the FCC on “Reassessment of Exposure to Radiofrequency Electromagnetic Fields Limits and Policies”](#) August 29, 2013; Fernández, C., de Salles, A., Sears, M., Morris, R., & Davis, D. (2018). “[Absorption of wireless radiation in the child versus adult brain and eye from cell phone conversation or virtual reality.](#)” Environmental Research, 167, 694-699. <https://doi.org/10.1016/j.envres.2018.05.013>
6. James C. Lin. [Science, Politics, and Groupthink \[Health Matters\]](#). IEEE Microwave Magazine. 22(5):24-26. May 2021; Lennart Hardell, Michael Carlberg, [Health risks from radiofrequency radiation, including 5G, should be assessed by experts with no conflicts of interest.](#) Oncol Lett. 2020 Oct;20(4):15.; Lennart Hardell, Mona Nilsson, Tarmo Koppel, Michael Carlberg. [Aspects on the International Commission on Non-Ionizing Radiation Protection \(ICNIRP\) 2020 Guidelines on Radiofrequency Radiation.](#) J Cancer Sci Clin Ther. 2021; 5(2): 250-285; Hardell L. “[World Health Organization, radiofrequency radiation and health – a hard nut to crack \(Review\)](#)” Int J Oncol 51 (2017): 405-413; Hans van Scharen, Tomas Vanheste, Erik Lambert for European Members of Parliaments Michèle Rivasi and Dr. Klaus Buchner “[The International Commission on Non-Ionizing Radiation Protection: Conflicts of Interest, Corporate Capture and the Push for 5G.](#)” (PDF)
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November 19, 2021

The Honorable Jessica Rosenworcel
Chairwoman
Federal Communications Commission
445 12th Street, SW
Washington, D.C. 20554

Dear Chairwoman Rosenworcel,

The Environmental Working Group, a nonprofit public health research and advocacy organization with offices in Washington, D.C, Minneapolis, and Sacramento, Calif., requests that the Federal Communications Commission reopen Docket #13-84, “Reassessment of FCC Radiofrequency Exposure Limits and Policies,” and Docket #03-137, “Proposed Changes to the Commission Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields,” to allow robust review and consideration of scientific evidence published in the past two years and in response to the court ruling in *Environmental Health Trust et al. v. the FCC*.

Since 2009, the Environmental Working Group has extensively researched the topic of the human and environmental health impacts of radiofrequency radiation emitted from wireless communication devices. EWG also closely follows regulatory approaches and recommendations on radiofrequency radiation made by authoritative health agencies around the world. The World Health Organization states on its website:

... during the 20th century, environmental exposure to man-made sources of EMF steadily increased due to electricity demand, ever-advancing wireless technologies and changes in work practices and social behaviour. Everyone is exposed to a complex mix of electric and magnetic fields at many different frequencies, at home and at work, and concern continues to grow over possible health effects from overexposure.¹

Extensive research literature points to the potential health risks of radiofrequency radiation, particularly for the developing child. Peer-reviewed studies show that the

¹ World Health Organization, web page not dated, “Supporting the development of national policies on electromagnetic fields”. <https://www.who.int/activities/supporting-the-development-of-national-policies-on-electromagnetic-fields> Accessed Nov. 16, 2021.



bodies of children absorb more radiofrequency radiation, compared to adults, putting children at greater health risk as a result to such exposure.²

Scientists and public health advocates have raised concerns for decades about the adverse health effects of exposure to electromagnetic radiation. Recent research publications highlight the severity of these impacts, especially among vulnerable populations, and the need for more stringent health-based exposure standards. In 2011, the International Agency for Research on Cancer (IARC), an agency of the World Health Organization, classified radiofrequency electromagnetic fields as “possibly carcinogenic to humans.”³

For today’s generation of children, exposure to radiofrequency radiation from wireless communication devices starts from the fetal development period as a result of wireless devices in the pregnant person’s everyday environment. Following birth, today’s children will be exposed to radiofrequency radiation throughout their lives – an exposure scenario that is drastically different from the very limited consumer use and exposure to wireless radiation of the 1980s and 1990s, when the basis for current FCC standards was established.

This comment letter highlights two key considerations that point to the need for the FCC to reassess existing radiofrequency exposure limits and policies:

1. A 2021 peer-reviewed publication we authored that uses Environmental Protection Agency methodology to determine protective health-based exposure limits for radiofrequency radiation, based on the U.S. government’s landmark 2018 laboratory study; and
2. Recent literature that documents a range of effects of non-ionizing electromagnetic radiation on different body systems that current FCC standards do not take into account.

1. Health-based limits developed with consideration for children’s health

² Fernández C, de Salles AA, Sears ME, Morris RD, Davis DL. Absorption of wireless radiation in the child versus adult brain and eye from cell phone conversation or virtual reality. *Environ Res.* 2018; 167:694-699. <https://doi.org/10.1016/j.envres.2018.05.013>; Gandhi OP, Morgan LL, de Salles AA, Han YY, Herberman RB, Davis DL. Exposure limits: the underestimation of absorbed cell phone radiation, especially in children. *Electromagn Biol Med.* 2012; 31(1):34-51. <https://doi.org/10.3109/15368378.2011.622827>

³ International Agency for Research on Cancer. IARC classifies radiofrequency electromagnetic fields as possibly carcinogenic to humans. Press Release N: 208. 2011. https://www.iarc.who.int/wp-content/uploads/2018/07/pr208_E.pdf Accessed Nov. 16, 2021.



A peer-reviewed article published by our organization in 2021 (Uche & Naidenko, 2021)⁴ documented how the current FCC exposure limit for radiofrequency radiation is not sufficient to protect the general population, especially children, against the adverse impacts associated with radiofrequency radiation exposure. The current limit, last revised a quarter-century ago – well before wireless devices became ubiquitous – needs to be updated with the latest science to be fully health protective for all users of wireless communication technologies.

Our study, published in the journal *Environmental Health*, recommends strict, lower health-based exposure standards for both children and adults for radiofrequency radiation emitted from wireless devices. This recommendation draws on data from a landmark 2018 study from the National Toxicology Program, one of the largest long-term laboratory studies on the health effects of radiofrequency radiation exposure.⁵

EWG's study used an approach similar to the methodology that the U.S. EPA developed to assess human health risks arising from toxic chemical exposures. EWG study recommends a whole-body specific absorption rate (SAR) limit of 0.2 to 0.4 mW/kg for children, which is 200 to 400 times lower than the current federal whole-body exposure limit. For adults, EWG recommends a whole-body specific absorption rate limit of 2 to 4 mW/kg, which is 20 to 40 times lower than the federal limit (Uche & Naidenko, 2021).⁴

EWG's analysis and recommendation for a much stricter limit for radiofrequency radiation exposure is a step toward advancing a re-evaluation of the existing federal limit for radiofrequency radiation exposure while reviewing the latest research on radiofrequency radiation exposure.

2. Wide range of potential impacts of non-ionizing electromagnetic radiation on human health not accounted for in the current FCC standard

⁴ Uche UI, Naidenko OV. Development of health-based exposure limits for radiofrequency radiation from wireless devices using a benchmark dose approach. *Environ Health*. 2021; 20(1):84.

<https://doi.org/10.1186/s12940-021-00768-1>

⁵ National Toxicology Program. 595: NTP Technical Report on the Toxicology and Carcinogenesis Studies in Hsd: Sprague Dawley SD Rats Exposed to Whole-Body Radio Frequency Radiation at a Frequency (900 MHz) and Modulations (GSM and CDMA) Used by Cell Phones. National Toxicology Program, US Department of Health and Human Services. 2018.

https://ntp.niehs.nih.gov/ntp/htdocs/lt_rpts/tr595_508.pdf?utm_source=direct&utm_medium=prod&utm_campaign=ntpgolinks&utm_term=tr595



The current FCC standard was based on the 1986 recommendations of the National Council on Radiation Protection and Measurements⁶ and 1991 recommendations of the Institute of Electrical and Electronics Engineers,⁷ which chose an exposure level based on behavioral changes observed in laboratory animals exposed to radiofrequency radiation for a duration of minutes to hours in studies conducted in the 1970s and 1980s. With extensive current research linking radiofrequency exposure to adverse impacts, even at exposure levels below the current federal limit, the FCC needs to review the latest science and update the allowable exposure limits.

Among the reported biological effects of electric and magnetic fields are harm to fetal growth and development (Ozgun et al., 2013);⁸ changes in brain activity (Wallace and Selmaoui, 2019);⁹ changes in heart rate variability (Wallace et al., 2020);¹⁰ DNA damage (Smith-Roe et al., 2020);¹¹ cognitive effects (Azimzadeh and Jelodar);¹² and increased risk of cancer, including gliomas,³ parotid gland tumors (Sadetzki et al., 2008),¹³ thyroid cancers (Luo et al., 2019).¹⁴ These adverse health effects may be associated with different mechanistic pathways, such as changes in the activity of voltage-gated calcium

⁶ National Council on Radiation Protection and Measurements. Biological effects and exposure criteria for radiofrequency electromagnetic fields: NCRP Report No. 86; 1986. Available from: <https://ncrponline.org/shop/reports/report-no-086-biological-effects-and-exposure-criteria-for-radiofrequency-electromagnetic-fields-1986/>

⁷ Institute of Electrical and Electronics Engineers. (Revision of ANSI C95.1–1982). IEEE standard for safety levels with respect to human exposure to radio frequency electromagnetic fields, 3 kHz to 300 GHz. IEEE Std C95. 1991. <https://doi.org/10.1109/IEEESTD.1992.101091>

⁸ Ozgur E, Kismali G, Guler G, Akcay A, Ozkurt G, Sel T, et al. Effects of prenatal and postnatal exposure to GSM-like radiofrequency on blood chemistry and oxidative stress in infant rabbits, an experimental study.

Cell Biochem Biophys. 2013;67(2):743–51. <https://doi.org/10.1007/s12013-013-9564-1>

⁹ Wallace J, Selmaoui B. Effect of mobile phone radiofrequency signal on the alpha rhythm of human waking EEG: a review. Environ Res. 2019; 175:274–86. <https://doi.org/10.1016/j.envres.2019.05.016>

¹⁰ Wallace J, Andrianome S, Ghosn R, Blanchard ES, Telliez F, Selmaoui B. Heart rate variability in healthy young adults exposed to global system for mobile communication (GSM) 900-MHz radiofrequency signal from mobile phones. Environ Res. 2020; 191:110097. <https://doi.org/10.1016/j.envres.2020.110097>

¹¹ Smith-Roe SL, Wyde ME, Stout MD, Winters JW, Hobbs CA, Shepard KG, et al. Evaluation of the genotoxicity of cell phone radiofrequency radiation in male and female rats and mice following subchronic exposure. Environ Mol Mutagen. 2020; 61(2):276–90. <https://doi.org/10.1002/em.22343>

¹² Azimzadeh M, Jelodar G. Prenatal and early postnatal exposure to radiofrequency waves (900 MHz) adversely affects passive avoidance learning and memory. Toxicol Ind Health. 2020;36(12):1024–30. <https://doi.org/10.1177/0748233720973143>

¹³ Sadetzki S, Chetrit A, Jarus-Hakak A, Cardis E, Deutch Y, Duvdevani S, et al. Cellular phone use and risk of benign and malignant parotid gland tumors – a nationwide case-control study. Am J Epidemiol. 2008;167(4):457–67. <https://doi.org/10.1093/aje/kwm325>

¹⁴ Luo J, Deziel NC, Huang H, Chen Y, Ni X, Ma S, et al. Cell phone use and risk of thyroid cancer: a population-based case-control study in Connecticut. Ann Epidemiol. 2019; 29:39–45. <https://doi.org/10.1016/j.annepidem.2018.10.004>



channels (Blackman et al., 1991);¹⁵ changes in the concentrations of reactive oxygen species and redox homeostasis (Ertilav et al., 2018);¹⁶ changes in intracellular enzymes and gene expression (Fragopoulou et al., 2018);¹⁷ and changes in membrane permeability (Perera et al., 2018).¹⁸

Table 1. Extensive research points to effects of non-ionizing electromagnetic radiation on individual body systems that are not considered by the current FCC standards for cell phone radiation.

Reported health effects	Key studies
Elevated risk of brain cancer, breast cancer, parotid gland tumors, and thyroid cancer	<p>Choi YJ, Moskowitz JM, Myung SK, Lee YR, Hong YC. Cellular Phone Use and Risk of Tumors: Systematic Review and Meta-Analysis. <i>Int J Environ Res Public Health</i>. 2020; 17(21):8079.</p> <p>West JG, Kapoor NS, Liao SY, Chen JW, Bailey L, Nagourney RA. Multifocal Breast Cancer in Young Women with Prolonged Contact between Their Breasts and Their Cellular Phones. <i>Case Rep Med</i>. 2013; 2013:354682</p> <p>Sadetzki S, Chetrit A, Jarus-Hakak A, Cardis E, Deutch Y, Duvdevani S, et al. Cellular phone use and risk of benign and malignant parotid gland tumors – a nationwide case-control study. <i>American journal of epidemiology</i> 2008; 167(4):457-67.</p> <p>Luo J, Li H, Deziel NC, Huang H, Zhao N, Ma S, et al. Genetic susceptibility may modify the association between cell phone</p>

¹⁵ Blackman C, Benane S, House D. The influence of temperature during electric-and magnetic-field-induced alteration of calcium-ion release from in vitro brain tissue. *Bioelectromagnetics*. 1991;12(3):173–82. <https://doi.org/10.1002/bem.2250120305>

¹⁶ Ertilav K, Uslusoy F, Ataizi S, Nazıroğlu M. Long term exposure to cellphone frequencies (900 and 1800 MHz) induces apoptosis, mitochondrial oxidative stress and TRPV1 channel activation in the hippocampus and dorsal root ganglion of rats. *Metab Brain Dis*. 2018;33(3):753–63. <https://doi.org/10.1007/s11011-017-0180-4>

¹⁷ Fragopoulou AF, Polyzos A, Papadopoulou MD, Sansone A, Manta AK, Balafas E, et al. Hippocampal lipidome and transcriptome profile alterations triggered by acute exposure of mice to GSM 1800 MHz mobile phone radiation: an exploratory study. *Brain Behavior*. 2018; 8(6):e01001. <https://doi.org/10.1002/brb3.1001>

¹⁸ Perera PGT, Nguyen THP, Dekiwadia C, Wandiyanto JV, Sbarski I, Bazaka O, et al. Exposure to high-frequency electromagnetic field triggers rapid uptake of large nanosphere clusters by pheochromocytoma cells. *Int J Nanomed*. 2018;13:8429. <https://doi.org/10.2147/IJN.S183767>



	use and thyroid cancer: A population-based case-control study in Connecticut. <i>Environmental Research</i> . 2020; 182:109013.
Eye strain, damage to eye tissues cataracts	Bormusov E, P Andley U, Sharon N, Schächter L, Lahav A, Dovrat A. Non-thermal electromagnetic radiation damage to lens epithelium. <i>Open Ophthalmol J</i> . 2008; 2:102-6
Cardiomyopathy, heart rate variability	National Toxicology Program. 2018. Technical Report on the Toxicology and Carcinogenesis Studies in Hsd: Sprague Dawley SD Rats Exposed to Whole-Body Radio Frequency Radiation at a Frequency (900 MHz) and Modulations (GSM and CDMA) Used by Cell Phones. Wallace J, Andrianome S, Ghosn R, Blanchard ES, Telliez F, Selmaoui B. Heart rate variability in healthy young adults exposed to global system for mobile communication (GSM) 900-MHz radiofrequency signal from mobile phones. <i>Environmental Research</i> 2020; 191:110097
Damage to sperm, decreased male fertility	Kesari KK, Agarwal A, Henkel R. Radiations and male fertility. <i>Reprod Biol Endocrinol</i> . 2018; 16(1):118
Changes in brain activity	Volkow ND, Tomasi D, Wang G-J, Vaska P, Fowler JS, Telang F, et al. Effects of cell phone radiofrequency signal exposure on brain glucose metabolism. <i>JAMA</i> 2011; 305(8):808-13
Changes in blood- brain barrier	Wallace J, Selmaoui B. Effect of mobile phone radiofrequency signal on the alpha rhythm of human waking EEG: A review. <i>Environmental research</i> . 2019; 175:274-86
Changes in the immune system function	Piszczyk P, Wójcik-Piotrowicz K, Gil K, Kaszuba-Zwoińska J. Immunity and electromagnetic fields. <i>Environ Res</i> . 2021; 200:111505.

As documented in Table 1, exposure to non-ionizing electromagnetic fields can harm a variety of organs and body systems, highlighting the urgency of a public-health-focused reassessment of existing exposure limits for radiofrequency radiation. Further, exposure to non-ionizing electromagnetic fields during pregnancy has been associated with an



increased risk of miscarriage (Li et al., 2017)¹⁹ and an increased frequency of hyperactivity and inattention during early childhood (Birks et al., 2017).²⁰

In conclusion, the Environmental Working Group urges the FCC to open its record for a more comprehensive evaluation of radiofrequency radiation and update its standard to ensure the safety of wireless radiation devices for everyone, especially young children.

Submitted on behalf of the Environmental Working Group,

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Environmental Working Group

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Environmental Working Group

¹⁹ Li DK, Chen H, Ferber JR, Odouli R, Quesenberry C. Exposure to Magnetic Field Non-Ionizing Radiation and the Risk of Miscarriage: A Prospective Cohort Study. *Sci Rep.* 2017; 7(1):17541. <https://doi.org/10.1038/s41598-017-16623-8>

²⁰ Birks L, Guxens M, Papadopoulou E, Alexander J, Ballester F, Estarlich M, Gallastegi M, Ha M, Haugen M, Huss A, Kheifets L, Lim H, Olsen J, Santa-Marina L, Sudan M, Vermeulen R, Vrijkotte T, Cardis E, Vrijheid M. Maternal cell phone use during pregnancy and child behavioral problems in five birth cohorts. *Environ Int.* 2017; 104:122-131. <https://doi.org/10.1016/j.envint.2017.03.024>

November 9, 2021

The Honorable Jessica Rosenworcel, Commissioner
Acting Chairwoman
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Dear Chairwoman Rosenworcel,

I am writing to request that the FCC re-open Docket #13-84 “Reassessment of FCC Radiofrequency Exposure Limits and Policies” and Docket #03-137 “Proposed Changes to the Commission Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields- in order to refresh the record before responding to the mandate of the August 13, 2021 [judgment](#) by the U.S. Court of Appeals for the District of Columbia Circuit, in Environmental Health Trust et al. v. the FCC.

I am Professor and Chair Emeritus at the University of New Hampshire Department of Electrical & Computer Engineering and served on the New Hampshire State Commission on 5G Technology. After a year of investigation we issued our [final report](#) on November 1, 2020.

I want to ensure the fifteen recommendations of the expert New Hampshire State Commission are considered by the FCC. If the FCC does not re-open the record, the Report will not be available to the Commission as it was finalized in 2020.

Sincerely



Digitally signed by Kent
Chamberlin
Date: 2021.11.09 21:21:17 -05'00'

Kent Chamberlin, PhD
Professor & Chair Emeritus

New Hampshire State Commission on 5G Technology Final Report Recommendations

RECOMMENDATION 1

Propose a resolution of the House to the US Congress and Executive Branch to require the Federal Communication Commission (FCC) to commission an independent review of the current radiofrequency (RF) standards of the electromagnetic radiation in the 300MHz to 300GHz microwave spectrum as well as a health study to assess and recommend mitigation for the health risks associated with the use of cellular communications and data transmittal.

RECOMMENDATION 2

Require that the most appropriate agency (agencies) of the State of New Hampshire include links on its (their) website(s) that contain information and warnings about RF-radiation from all sources, but specifically from 5G small cells deployed on public rights-of-way as well as showing the proper use of cell phones to minimize exposure to RF-radiation, with adequate funding granted by the Legislature. In addition, public service announcements on radio, television, print media, and internet should periodically appear, warning of the health risks associated with radiation exposure. Of significant importance are warnings concerning the newborn and young as well as pregnant women.

RECOMMENDATION 3

Require every pole or other structure in the public rights of- way that holds a 5G antenna be labeled indicating RF-radiation being emitted above. This label should be at eye level and legible from nine feet away.

RECOMMENDATION 4

Schools and public libraries should migrate from RF wireless connections for computers, laptops, pads, and other devices, to hardwired or optical connections within a five-year period starting when funding becomes available.

RECOMMENDATION 5

Signal strength measurements must be collected at all wireless facilities as part of the commissioning process and as mandated by state or municipal ordinances. Measurements are also to be collected when changes are made to the system that might affect its radiation, such as changes in the software controlling it. Signal strength is to be assessed under worst-case conditions in regions surrounding the tower that either are occupied or are accessible to the public, and the results of the data collection effort is to be made available to

the public via a website. In the event that the measured power for a wireless facility exceeds radiation thresholds, the municipality is empowered to immediately have the facility taken offline. The measurements are to be carried out by an independent contractor and the cost of the measurements will be borne by the site installer.

RECOMMENDATION 6

Establish new protocols for performing signal strength measurements in areas around wireless facilities to better evaluate signal characteristics known to be deleterious to human health as has been documented through peer-reviewed research efforts. Those new protocols are to take into account the impulsive nature of high-data-rate radiation that a growing –body of evidence shows as having a significantly greater negative impact on human health than does continuous radiation. The protocols will also enable the summative effects of multiple radiation sources to be measured.

RECOMMENDATION 7

Require that any new wireless antennas located on a state or municipal right-of-way or on private property be set back from residences, businesses, and schools. This should be enforceable by the municipality during the permitting process unless the owners of residences, businesses, or school districts waive this restriction.

RECOMMENDATION 8

Upgrade the educational offerings by the NH Office of Professional Licensure and Certification (OPLC) for home inspectors to include RF intensity measurements.

RECOMMENDATION 9

The State of New Hampshire should begin an effort to measure RF intensities within frequency ranges throughout the state, with the aim of developing and refining a continually updated map of RF exposure levels across the state using data submitted by state-trained home inspectors.

RECOMMENDATION 10

Strongly recommend all new cell phones and all other wireless devices sold come equipped with updated software that can stop the phone from radiating when positioned against the body.

RECOMMENDATION 11

Promote and adopt a statewide position that would strongly encourage moving forward with the deployment of fiber optic cable connectivity, internal wired connections, and optical wireless to serve all commercial and public properties statewide.

RECOMMENDATION 12

Further basic science studies are needed in conjunction with the medical community outlining the characteristics of expressed clinical symptoms related to radio frequency radiation exposure. The majority of the Commission feels the medical community is in the ideal position to clarify the clinical presentation of symptoms precipitated by the exposure to radio frequency radiation consistent with the Americans with Disabilities Act (ADA) which identifies such a disability. The medical community can also help delineate appropriate protections and protocols for affected individuals. All of these endeavors (basic science, clinical assessment, epidemiological studies) must be completely independent and outside of commercial influence.

RECOMMENDATION 13

Recommend the use of exposure warning signs to be posted in commercial and public buildings. In addition, encourage commercial and public buildings, especially healthcare facilities, to establish RF-radiation free zones where employees and visitors can seek refuge from the effects of wireless RF emissions.

RECOMMENDATION 14

The State of New Hampshire should engage agencies with appropriate scientific expertise, including ecological knowledge, to develop RF-radiation safety limits that will protect the trees, plants, birds, insects, and pollinators.

RECOMMENDATION 15

The State of New Hampshire should engage our Federal Delegation to legislate that under the National Environmental Policy Act (NEPA) the FCC do an environmental impact statement as to the effect on New Hampshire and the country as a whole from the expansion of RF wireless technologies.



November 24, 2021

The Honorable Jessica Rosenworcel
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Dear Chairwoman Rosenworcel,

I am a physician in France and for the past fifteen years I have been working on the documented health issues related to cell phone radiation as well as the cell phone SAR test procedures.

In regards to the recent U.S. DC Circuit Court of Appeals' ruling in EHT v FCC, we are writing to request that the FCC re-open Dockets #13-84 and #03-137 to allow new, significant policy developments and research be included for consideration because of its relevance to the FCC examining its cell phone SAR testing procedures.

I am President of the Phonégate Alerte Association, formed in 2018 and our efforts to ensure transparency have led to the French government's actions to withdraw or update at least 23 models of cell phones from different manufacturers (Xiaomi, Nokia, Huawei, Wiko, Alcatel, etc.) because they were found to exceed European Union regulatory SAR limits for human exposure to radiofrequency radiation.

Similar to the FCC's regulations on cell phone test procedures, European Union regulations allow manufacturers to test cell phones at 5 mm separation distance from the body. They do not force companies to test cell phones or wireless devices at positions that are directly against the body (0 mm separation distance) *despite the reality that billions of people are using cell phones close to the body.*

The French Government is Requesting 0 mm Cell Phone Radiation Testing

In late 2019, the French government health agency ANSES issued a [report](#)¹ on the possible health effects associated with high radiation from mobile telephones carried close to the body and recommended that cell phones be tested at 0 millimeters, instead of 5 mm as the European Commission regulations require. Subsequently, France submitted a [formal objection](#)² to the European Commission in regards to the

¹ <https://www.anses.fr/en/content/exposure-mobile-telephones-carried-close-body>

² <https://ec.europa.eu/docsroom/documents/43448>

current compliance test separation distance requirements of only 5 mm. The authorities have requested that compliance test distances be revised to 0 mm

“Developments in the use of mobile telephones have led to a wide variety of situations in which telephones are no longer exclusively held close to a person’s ear in order to hold a conversation, since they are now also used to send and receive data through various applications for listening to music, playing video games or making video calls, which means that the equipment is used in ways which were not previously foreseen. There is also a growing trend for telephones to be networked with numerous connected objects, such as headsets or watches, which tend to result in lengthy connections between a telephone and the mobile network without the telephone being held in the hand, since it is often carried in clothing and is therefore closer to – or in contact with – the trunk.

For this reason, the French authorities believe that it is necessary to revise the harmonised standard EN 50566: 2017 concerning measurements of the SAR of devices that are hand-held or body-mounted in close proximity to the human body so that a maximum distance of 0 mm from the body is taken into consideration.”

The FCC should ensure that cell phones are tested in body contact positions at 0 mm.

For background, in 2016, the French National Frequency Agency (ANFR) officially tested various models of cell phones and found that the majority exceeded regulatory limits when tested in body contact positions - with 0 mm between the phone and simulated body testing device (aka “phantom”).

Cell Phones Violate Radiation Limits

Since December 4, 2019 ANFR has posted *143 new cell phone SAR test reports*. Despite the fact that the European Union strengthened their requirements to ensure cell phones were tested at 5 mm from the body, many cell phone models are still violating the limit of 2.0 W/kg for trunk SAR when tested by ANFR (10 g of tissue). All of the test results are [posted online](#)³.

Examples of smartphones that **violated the EU limits of 2.0 W/kg as well as the FCC limit of 1.6 W/kg when SAR radiation tested by the ANFR at 5mm include:**

- February 26, 2020: Sony Xperia 5 violated the limit at 2.64 W/kg.
- November 12, 2020: Essential Heyou 40 violated the limit at 2.54 W/kg⁴
- September 9, 2020: Essential Heyou 60 violated the limit at 2.86 W/kg⁵
- February 26, 2020: Xiaomi Mi Note 10 violated the limit at 2.45 W/kg⁶

3

https://data.anfr.fr/explore/dataset/das-telephonie-mobile/table/?disjunctive.marque&disjunctive.modele&dataC hart=eyJxdWVyaWVzljpbeyJjb25maWciOnsiZGF0YXNldCI6ImRhcY10ZWxlGhvbmlLLW1vYmIsZSIsIm9wdGlbnMiOnsiZGZanVuY3RpdmUubWVycXVlIjpb0cnVILCJkaXNqdW5jdGl2ZS5tb2RlbgUiOnRydWV9fSwiY2hhcnRzljpbeyJ0eXBlljoib GluZSIsImZ1bmMiOiJlBVkciLCJ5QXhpcyl6ImRhc190ZXRIX25vcmlX25mX2VuXzUwMzYwliwic2NpZW50aWZpY0Rpc3 BsYXkiOnRydWUsImNvbG9yYljoilzY2YzJhNSJ9XSwieEF4aXMiOiJkYXRlX2R1X2NvbRyb2xlX3Bhcl9sX2FuZnliLCJtYXhwb 2ludHMioiilLCJ0aW1lc2NhbGUioiJ5ZWYliwic29vdCI6IiJ9XX0%3D&sort=das_tronc_au_contact

⁴ <https://www.anfr.fr/das/COM054200035>

⁵ <https://www.anfr.fr/das/COM054200035>

⁶ <https://www.anfr.fr/das/COM006200006/>

Examples of smartphones **that would be compliant with the EU limit but would violate the FCC limits of 1.6 W/kg when SAR radiation tested by the ANFR at 5mm include:**

- September 16, 2020 Logicom Le Fleep 178 violated FCC's limit at 1.94 W/kg⁷
- September 16, 2020: Sky 55 Konrow violated FCC's limit at 1.91 W/kg⁸
- September 30, 2020: Wiki Lubi 5 Plus violated FCC's limit at 1.9 W/kg⁹
- September 29, 2020: Nokia 5.1 violated FCC's limit at 1.82 W/kg¹⁰
- April 8, 2021: Wiko F 300 violated FCC's limit at 1.8 W/kg¹¹

As European Union and FCC test procedures utilize different averaging volumes, one cannot directly compare the measurements. However, FCC test procedures could result in even higher SAR violations ([Gandhi 2019](#))¹².

Unfortunately ANFR no longer tests cell phones in body contact positions with 0 mm distance from the phone to the body phantom. If they did, far more of the 143 cell phones tested in the last two years would violate FCC and EU limits because every millimeter can significantly increase exposure. Further, due to the averaging volume differences between the FCC and EU limits, several of the phones that ANFR finds are compliant with the 1.6 W/kg limit would violate the FCC's test procedures.

The FCC presently allows manufacturers to SAR test cell phones with a separation distance between the phone and body (which can be up to approximately one inch from the body in some models of phones still in use in the USA) inaccurately measuring SAR levels into the body. Actual SAR exposure in direct body contact positions would be much higher than FCC test measurements.

New Research on Metal and Radiation Levels

Studies on SAR in human tissue published since 2019 related to cell phone test procedures need to be included in the FCC re-examination. Metal can reflect and refocus cellular radiation, resulting in much higher absorption rates. The FCC, states, "Electrically conductive objects in or on the body may interact with sources of RF energy in ways that are not easily predicted. Examples of conductive objects in the body include implanted metallic objects. Examples of conductive objects on the body include eyeglasses, jewelry, or metallic accessories."

- In January 2021 the study "[Experimental Validation for Temperature Rise in Human Tissue Due to Implanted Metal Plates with Screw Holes Using Translucent Solid Phantom](#)" was published in 2020 International Symposium on Antennas and Propagation (ISAP), Osaka, Japan IEEE, 2021 and found increases in SAR enhancement due to the implanted metallic plates observed at specific frequencies.¹³
- On December 2020, the study [The effect of metal objects on the SAR and temperature increase in the human head exposed to dipole antenna \(numerical analysis\)](#) published in Case Studies in Thermal Engineering found "the presence of metal objects in proximity to the head alters SAR and temperature increase within the tissues. In most cases, metal objects redistribute the EM

⁷ <https://www.anfr.fr/das/COM044200035>

⁸ <https://www.anfr.fr/das/COM044200036>

⁹ <https://www.anfr.fr/das/COM046200002>

¹⁰ <https://www.anfr.fr/das/COM085200003>

¹¹ <https://www.anfr.fr/das/COM057210009>

¹² <https://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=8688629>

¹³ <https://ieeexplore.ieee.org/document/9391129>

field incident upon them to a smaller region increasing power absorption, thereby increasing SAR and temperature in that region. The power absorption in head layers is found to be sensitive to metal object's size and shape, and distance of the antenna from the objects".¹⁴

These are just a few of the published studies on radiation levels will not be included in the FCC's examination of cell phone test procedures *unless the FCC refreshes the record*.

Investigative Reports on Telecom Influence

In September 2020, the editor-in-chief of the Program 66 minutes interviewed Chicago Tribune journalist and Pulitzer Prize winner Sam Roe and myself discussing how FCC's cell phone test procedures allow violations of FCC limits because they do not require cell phones to be tested at 0 mm.¹⁵

On November 12, 2020, France Télévisions Complément d'Investigation "5G A Wave of Doubt" directed by investigative journalist Nicolas Vescovacci was broadcast on France 2¹⁶. The investigation described how cell phones exceed radiation thresholds when tested against the body and how cell phones are being taken off the market in response. Importantly, the industry ties of members of International Commission on Non-Ionizing Radiation Protection (ICNIRP) were revealed. In June 2020, a report released by European Members of Parliament Michèle Rivasi (Europe Écologie) and Dr. Klaus Buchner (Ökologisch-Demokratische Partei) found that ICNIRP has long ignored the science on non thermal effects¹⁷.

This 2020 investigative research must be included in the FCC's record review so that the FCC does not inadvertently allow the wireless industry to influence its review of the record and decision.

There is Not a 50-Fold Safety Factor for Cell Phone Local SAR

Furthermore, we would like to importantly note that after we questioned ICNIRP President Rodney Croft and Vice President Eric Van Rongen, we received confirmation that there is not a 50 fold safety factor when it comes to ICNIRP's cell phone local SAR limit.

Here is what Mr. Van Rongen wrote about this:

"Anyone who states that a reduction factor of 50 applies to local exposures obviously misinterprets the guidelines, although the 1998 guidelines might not have been very clear in that respect the 2020 ones provide more clear information."

On December 17, 2019 Environmental Health Trust and Phonegate Association write members of Congress a letter¹⁸ and Background and Facts document¹⁹ on the urgent need for a hearing regarding cell phone radiation test procedures, due to the excessive radiation the phone can expose the user to in body contact positions.

¹⁴ <https://www.sciencedirect.com/science/article/pii/S2214157X20305311?via%3Dihub>

¹⁵ [Phonegate : entretien avec le journaliste américain et prix Pulitzer Sam Roe](#)

¹⁶ https://www.francetvinfo.fr/replay-magazine/france-2/complement-d-enquete/complement-d-enquete-5g-londe-dun-doute_4152949.html

¹⁷ <https://ehtrust.org/wp-content/uploads/ICNIRP-report-FINAL-JUNE-2020.pdf>

¹⁸ <https://ehtrust.org/wp-content/uploads/Signed-Letter-to-US-Congress-phonegate-.pdf>

¹⁹ [Background and Facts Documenting PhoneGate and Our Call for Congressional Action
https://ehtrust.org/wp-content/uploads/Background-and-Facts-on-PhoneGate-1-1.pdf](https://ehtrust.org/wp-content/uploads/Background-and-Facts-on-PhoneGate-1-1.pdf)

We have a significant amount of new data on SAR test methods from 2020 and 2021 to share with the FCC in order to ensure the protection of cell phone users, especially children. SAR tests are thermally based and they are an inadequate measurement to ensure safety. Stronger regulations which protect users from thermal and non-thermal effects are needed.

New Law To Require Radiation Testing of Wi-Fi Laptops, Router and Electronics

In addition, there has been new legislation regarding transparency on wireless radiation in France. Starting in July 2020, the wireless industry must label tablets, laptops, Wi-Fi routers, DECT phones and other wireless connected electronics with the radiofrequency radiation SAR exposure levels for consumers **at point of sale and for all advertising**. This includes the SAR for the head, trunk and extremities. All equipment used close to the head, hand-held or carried close to the body is potentially covered. From the [SAR Regulation Guide](#) provided by [ANFR](#), you can find a non-exhaustive list of equipment qualified as radio equipment that required SAR testing.

Note: For years [France law](#)²⁰ has ensured cell phones were SAR radiation labeled, banned the sale of cell phones designed for young children, prohibited advertising to children under 14 years of age²¹ and [warned](#)²² users to keep devices away from the body.

It is imperative that the two above-mentioned dockets are re-opened to allow recent developments to be submitted for a proper assessment of FCC's testing protocol.

Sincerely,

Marc Arazi, M.D.

A handwritten signature in blue ink, appearing to be 'M. Arazi', written over a light blue horizontal line.

President, PhoneGate Alert Association
35 rue François Rolland 94130
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DrArazi@phonegatealert.org

www.phonegatealert.org/en/

A book on Phonegate was published by Massot Editions on this international health scandal. An English version is planned and we will be sure to send it to you when it is released in the United States.

²⁰ [Article 183 - LOI n° 2010-788 du 12 juillet 2010 portant engagement national pour l'environnement \(1\)](#)

²¹ [Law on sobriety, transparency, information and consultation for exposure to electromagnetic waves](#)

²² [Order of November 15, 2019 relating to the display of the specific absorption rate of radioelectric equipment and to consumer information NOR: SSAP1834792A](#)



November 18, 2021

The Honorable Jessica Rosenworcel, Commissioner
Acting Chairwoman
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Dear Chairwoman Rosenworcel,

We are writing to request that the FCC re-open the relevant Dockets to ensure the latest science be included in the FCC's reexamination of the adequacy of its human exposure limits and regulations for radiofrequency radiation exposures.

We urge the Commission to look at new scientific evidence published since December 4, 2019. Of 39 new genetic effect studies, 79 % (31 studies) showed effects and 21 % (8 studies) did not show significant effects. Of 33 new neurological effect studies, 85 % (28 studies) showed effects and 15 % (5 studies) did not show significant effects. Of 30 new oxidative effect studies, 93% (28 studies) showed effects and 7 % (2 studies) did not show significant effects. The preponderance of scientific research on RFR continues on an upward trend.

There is a broad consensus among those in the scientific research community who are knowledgeable on the published literature, that new, biologically-based public safety limits for chronic exposure to radiofrequency radiation (RFR) are warranted now. The available evidence for health risks due to low intensity radiofrequency radiation exposures from wireless technology applications is sufficient and compelling. Research published over the last two years has added significant additional weight to the body of evidence which indicates that FCC public safety exposure limits are grossly inadequate to protect public health given the proliferation of RFR-emitting devices now in common usage.



The evidence for health risks comes directly from hundreds of published scientific and public health studies reporting that low-intensity RFR is capable of producing health harm across very large populations of exposed people.

The BioInitiative Working Group has been gathering and evaluating hundreds of such studies since 2006, and has published two large reports detailing this evidence. The group concluded that the scientific evidence was more than sufficient in 2007, and certainly in 2012 (www.bioinitiative.org) to establish new biologically-based exposure safety standards. Further, we have submitted numerous comments to the FCC since 2013 advising that the Commission has not struck the right balance between the wireless technologies rollout and managing resulting health impacts for Americans, particularly for children. The increased risk for cancers, neurological diseases, fertility and reproduction, immune dysfunction, memory and learning impairment, and other serious medical problems associated with exposure to low-intensity RF are documented and analyzed for the Commission to review at: <https://bioinitiative.org/research/summaries/>

When the cumulative body of evidence is assessed over the last decades of research, the overall picture for studies on radiofrequency radiation effects shows clear and consistent patterns of effects on living tissues. Chronic RFR exposures at environmental levels common today can reasonably be presumed to produce health harm at and below current FCC safety limits for humans and should be substantially lowered.

Genetic effects: Effect= 67% (259 studies); No Effect= 33% (129 studies) (literature up to November 12, 2021)

Neurological effects: Effect= 74% (271 studies); No Effect= 26% (97 studies) (literature up to November 12, 2021)

Oxidative effects: Effect= 92% (258 studies); No Effect= 8% (23) studies) (literature up to November 12, 2021)



Respectfully submitted on behalf of the BioInitiative Working Group by:

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Consumers for Safe Cell Phones

November 24, 2021

The Honorable Jessica Rosenworcel
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

Dear Chairwoman Rosenworcel,

As one of the petitioners who recently sought the DC Circuit Court of Appeal's review of the FCC's December 4th, 2019 decision to maintain their outdated 25 year old wireless exposure guidelines, we write to urge the Commission to follow the Court's directive to properly review the evidence that had been submitted into Dockets #13-84 and #03-137. A proper review requires that the two dockets be re-opened to allow newly published research and documents (made public over the past 2 years) to be included in the analysis. This will provide the FCC with up-to-date information to use in undertaking the Court's required thorough analysis.

The Court's ruling stated that the Commission "*must, in particular, (i) provide a reasoned explanation for its decision to retain its testing procedures for determining whether cell phones and other portable electronic devices comply with its guidelines...*"

Of particular concern to the Court is the failure of the FCC to review the evidence in the record related to assessing their inadequate cell phone testing guidelines. Since the GAO released their 2012 report¹ stating, "*The Federal Communications Commission's (FCC) RF energy exposure limit may not reflect the latest research, and testing requirements may not identify maximum exposure in all possible usage conditions... Some consumers may use mobile phones against the body, which FCC does not currently test, and could result in RF energy exposure higher than the FCC limit.*" - we have been calling on the FCC to test phones directly against the body with zero separation to simulate the manner in which they are typically used by consumers.

¹ "Telecommunications: Exposure and Testing Requirements for Mobile Phones Should Be Reassessed" - GAO-12-77:
Published: Jul 24, 2012

FCC’s current testing protocol allows a separation distance between the phone and the torso simulating use in a holster or belt clip, enabling a phone to pass the FCC compliance test when in fact, the exposure from phones used in real life usage positions will likely exceed the federal “safety” limit. This is because it is commonplace for today’s consumer to carry a transmitting phone in a pants or breast pocket or tucked into a bra with no separation between the antennas and the body.

Here are some examples of the RF warnings for wireless devices currently on the market in 2021:

- The Apple [iPhone 13 Pro Max RF Exposure statement](#)² reads, “iPhone is evaluated in positions that simulate uses against the head, with no separation, and when worn or carried against the torso of the body, with 5mm separation.” [Users will likely carry and use transmitting phones in pockets and bras against their body unaware because the RF “safety” warning is located in the small print of the legal section deep within menus on the phone where it is not likely to be found.]
- The [Miku Pro Smart Baby Monitor manual states](#)³, “RF EXPOSURE WARNING:This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.” [Yet many parents will locate these RF transmitting monitors close to the crib or in a child’s playroom unaware that these RF warnings are in the manual.]
- The [AT&T DECT 6.0 Home Cordless Phone manual](#)⁴ states, “The telephone base shall be installed and used such that parts of the user’s body other than the hands are maintained at a distance of approximately 20 cm (8 inches) or more.” [Yet many people install the base unit on the desk just inches from their head or on their bedside table unaware of these instructions.]

Key evidence has been published in the past two years that indicates cell phones directly in body contact (as when worn and used in a pants or shirt pocket or sports bra) are associated with an increased risk for breast tumors and sperm damage.

As examples, these 2020 and 2021 published studies referenced below must be included in a thorough FCC assessment of their cell phone testing protocol in order to perform a more “reasonable analysis” of the testing protocol:

I. “The Association Between Smartphone Use and Breast Cancer Risk Among Taiwanese Women: A Case-Control Study” - Cancer Manag Res 2020 Oct 29;12:10799-10807 doi: 10.2147/CMAR.S267415.

Results: “Participants who carried their smartphone near their chest or waist-abdomen area had significantly increased 5.03-fold and 4.06-fold risks of breast cancer”

II. “Effects of mobile phone usage on sperm quality - No time-dependent relationship on usage: A systematic review and updated meta-analysis” - 2021 Nov; 202:111784. doi: 10.1016/j.envres.2021.111784. Epub 2021 Jul 30

Results: “Exposure to mobile phones is associated with reduced sperm motility, viability, and concentration.” 18 studies were evaluated including 4280 samples.

² <https://www.apple.com/legal/rfexposure/iphone14,3/en/>

³ https://cdn.shopify.com/s/files/1/2621/9254/files/mikucare.com_quick_setup-guide.pdf?v=1589825520

⁴ https://att.vtp-media.com/products/CL/CL82X07/CL82X07_WEBCIB_i5.0_20201217.pdf

If the past two years of important research and evidence are not allowed to be included in the re-assessment of the FCC's cell phone testing protocol, it is certain that the public's distrust of the safety of phones and other wireless consumer devices will become even more widespread. The public's trust is dependent upon the FCC's thorough evaluation of the current, up to date body of research, especially with the advent of the novel and more powerful exposures expected with 5G.

Respectfully submitted,

Cynthia Franklin, Director
Consumers for Safe Cell Phones

“The digital transition as it is currently implemented participates to global warming more than it helps preventing it. The need for action is therefore urgent.”

- The Shift Project Report on the Environmental Impact of Information and Communication Technologies, 2019

Climate Change, 5G & the Internet of Things

Massive Increases in 5G Equipment = Massive Increases in Energy Use

Big Tech is Pushing 5G

5G requires millions of new cellular antennas called “small cells” (basically shorter cell towers) to be built in neighborhoods *directly in front of our homes*. These 5G antennas are to connect with billions of new wirelessly connected “smart” devices referred to as the Internet of Things (IoT). Researchers are warning us that the energy consumption of 5G and the IoT is projected to skyrocket.

5G is NOT Sustainable

The demand for technology is outstripping the increase in efficiency. The energy consumption will rise sharply due to the ever increasing IoT energy demands *at every stage of the lifecycle* of 5G equipment, from device manufacture to data centers to data transmissions, and networks.

5G is an Energy Hog

“A lurking threat behind the promise of 5G delivering up to 1,000 times as much data as today’s networks is that 5G could also consume up to 1,000 times as much energy.”

— IEEE Spectrum, 5G’s Waveform Is a Battery Vampire

We must consider the environmental footprint of the digital ecosystem.

“Behind each byte we have mining and metal processing, oil extraction and petrochemicals, manufacturing and intermediate transports, public works (to bury the cables) and power generation with coal and gas. As a result, the carbon footprint of the global digital system is already 4% of global greenhouse gas emissions, and its energy consumption rises by 9% per year.”

— Jean-Marc Jancovici, President of The Shift Project, member of the French High Climate Council

The digital version of this document is hyperlinked to online sources for more information. View all sources at EHT’s Climate Change webpage ehtrust.org/climate-change-and-5g

70.2 million

“small cell” tower bases to be installed by 2025

500 billion

devices are expected to be connected to the Internet by 2030

8.9 billion

mobile phone subscriptions worldwide by 2024

60% increase

per year in production of wireless peripherals (Wi-Fi/Bluetooth speakers, appliances, wearables)

700%

increase in mobile data traffic globally projected between 2017 and 2022

“Smart” is Not Smart. The push for all things wireless is the wrong direction.

5G Harms Bees, Trees and Birds



Research finds bees and pollinators absorb between 3% to 370% more of the higher frequencies of 5G, leading the scientists to warn, “This could lead to changes in insect behaviour, physiology, and morphology over time...”



Research finds wireless frequencies interfere with birds' navigation systems and circadian rhythms, and can harm their development and reproduction.



Research finds trees can be harmed by the standard radiation emissions from antenna equipment. Effects include altered growth, thinner cell walls and adverse biochemical changes.

Damage to the Tree Canopy

Trees play a vital role in mitigating climate change, sequestering millions of tons of carbon that would otherwise pollute our climate. The installation of 5G equipment often requires heavy pruning and digging. This will obviously damage the canopy and root system of our trees.

“Wireless devices, antenna networks and data centers are consuming an ever-increasing portion of the global energy supply, based largely on coal...”

— “Re-Inventing Wires: The Future of Landlines and Networks”

“Our energy calculations show that by 2015, wireless cloud will consume up to 43 TWh, compared to only 9.2 TWh in 2012, **an increase of 460%**. This is an **increase in carbon footprint** from 6 megatonnes of CO₂ in 2012 to up to 30 megatonnes of CO₂ in 2015, the equivalent of adding 4.9 million cars to the roads. Up to 90% of this consumption is attributable to wireless access network technologies, data centres account for only 9%...

...wireless access networks are clearly **the biggest and most inefficient consumer of energy** in the cloud environment.”

— The Centre for Energy Efficient Telecommunications, 2013

Solutions for fast, safe and secure internet connections do exist.

A national **wireline system** can guarantee a superior foundation of Internet access for everyone, unequalled connectivity speed, safety, privacy, security, energy efficiency and long-term sustainability.

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State of New Hampshire

GENERAL COURT

CONCORD

MEMORANDUM

DATE: November 1, 2020

TO: Honorable Christopher T. Sununu, Governor
Honorable Stephen J. Shurtleff, Speaker of the House
Honorable Donna Soucy, President of the Senate
Honorable Paul C. Smith, House Clerk
Honorable Tammy L. Wright, Senate Clerk
Michael York, State Librarian

FROM: Representative Patrick Abrami, Chair

SUBJECT: Final Report on Commission to Study the
Environmental and Health Effects of Evolving 5G Technology
(RSA 12-K:12-14, HB 522, Ch. 260, Laws of 2019)

Pursuant to RSA 12-K:14, III, enclosed please find the Final Report of the Commission to Study the Environmental and Health Effects of Evolving 5G Technology.

If you have any questions or comments regarding this report, please do not hesitate to contact me.

I would like to thank those members of the commission who were instrumental in this study. I would also like to acknowledge all those who testified before the commission and assisted the commission in our study.

Enclosures

cc: Members of the Commission

Final Report of the
Commission to Study
The Environmental and Health Effects of
Evolving 5G Technology

(HB 522, Chapter 260, Laws of 2019, RSA 12-K:12–14)

Membership

<u>Name</u>	<u>Organization/Representing</u>
Rep. Patrick Abrami (Chair)	NH House of Representatives
Rep. Kenneth Wells	NH House of Representatives
Rep. Gary Woods	NH House of Representatives
Sen. James Gray	NH Senate
Sen. Tom Sherman	NH Senate
Denise Ricciardi	Public
Brandon Garod, Esq.	Attorney General’s Office
Carol Miller	Department of Business and Economic Affairs
David Juvet	Business and Industry Association
Kent Chamberlin, PhD	University of New Hampshire
Bethanne Cooley	CTIA – wireless communications industry
Michele Roberge	Department of Health and Human Services
Paul Héroux, PhD	McGill University Medicine

November 1, 2020

Members of the Commission to Study the Environmental and Health Effects of Evolving 5G technology agree to the filing of this final report by the Chairman. This action should not be construed in any way as an adoption of any position by any Commission member or state agency or organization they represent on the underlying issue of the deployment of 5G technology.

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INTRODUCTION

Commission Responsibilities and Evolving Role

The Commission to Study the Environmental and Health Effects of Evolving 5G Technology came about from the passage and signing into law of [HB 522](#). The Legislature, after hearing testimony of potential health risks and the political ramifications of small cell antennae being deployed on the public rights-of-way throughout New Hampshire, agreed that a Commission be formed to take a deeper look at this evolving technology. For the record, 5G stands for the 5th Generation of wireless communication. This technology utilizes frequencies in the millimeter wave range of the electromagnetic spectrum. See [Appendix A](#) for a chart showing this spectrum.

What the Commission learned early on in its work is that you cannot talk about 5G without talking about the earlier generations 3G and 4G. Then the Commission embraced the concept of the Internet of Things (IoT) which is a world in which all electronic devices communicate via electromagnetic waves. This led to discussion of routers and other internal technologies. The devices receiving and sending signals via electromagnetic waves also became part of the discussion. So as the presentations and discussions went on, the Commission concluded that all things emitting radio frequency (RF) radiation needed to be considered together because of the interaction of all these waves. We also discovered early on that 5G means something different to each of the major cellular companies ranging from how 5G antennae interact with other generation antennae to whether small cell towers in the public right-of-way will be needed. The conclusion by many experts is that 5G is a marketing concept centered around speed of data transmission using many different engineering strategies.

At the heart of the discussion was the research as to whether non-ionizing radiation causes biological effects on humans as well as other living organisms, either animal or plant. No one argues that ionizing radiation from the high energy and frequency ultraviolet, x-ray, and gamma ray end of the electromagnetic spectrum are a danger to all living things. Of concern to the Commission, and internationally, are the electromagnetic waves in the microwave range of energy and frequency. There is mounting evidence that DNA damage can occur from

radiation outside of the ionizing part of the spectrum.^{1, 2, 3, 4} The Commission heard arguments on both sides of this issue with many now saying there are findings showing biological effects in this range. This argument gets amplified as millimeter waves within the microwave range are beginning to be utilized.

Then the Commission was presented with varying facts about the Federal Communication Commission (FCC) having total say over this issue as granted to it by Congress in the Telecommunication Act of 1996. In brief, this Act says, among many other things, that the siting of any antennae cannot be denied due to health concerns. Many on the Commission are concerned that this Act did not contemplate small cell towers being located on the public rights-of-way in front of people's homes. In addition, the FCC, using the science that they receive from other agencies and scientific/engineering associations, has set the allowable power intensity that can be emitted from these antennae. Testimony shows these limits are set well above many other industrialized nations. There are concerns by many Washington, DC watchers that the FCC is a captive agency whose Commission members come from the industry they are overseeing. These are the realities that can only be altered by Congressional action. As a New Hampshire Commission, as we moved through the Commission process, many of the members concluded we could first encourage our federal delegation to enact changes and second, assuming the federal realities cannot be changed, recommend protective measures that will stay within the current federal framework.

As far as the FCC and federal agencies, we made several attempts to have them testify before the Commission. The Commission was disappointed that they did not reply to these requests, because we thought it important for completeness of our work to hear from these agencies. When the agencies did not reply, we asked several agencies to answer very specific written questions. Instead of answering

¹ Aitken RJ, Bennetts LE, Sawyer D, Wiklendt AM, King BV. "Impact of radio frequency electromagnetic radiation on DNA integrity in the male germline." *Inter J Androl* 28:171-179, 2005, <https://pubmed.ncbi.nlm.nih.gov/15910543/>

² Akdag MZ, Dasdag S, Canturk F, Karabulut D, Caner Y, Adalier N. "Does prolonged radiofrequency radiation emitted from Wi-Fi devices induce in various tissues of rats?" *J Chem Neuroanat*, 75(Pt B):116-122, 2016, <https://pubmed.ncbi.nlm.nih.gov/26775760/>.

³ Akdag M, Dasdag S, Canturk F, Akdag MZ. "Exposure to non-ionizing electromagnetic fields emitted from mobile phones induced DNA damage in human ear canal hair follicle cells." *Electromagn Biol Med*. 37(2):66-75, 2018.

⁴ Al-Serori H, Ferk F, Kundi M, Bileck A, Gerner C, Mišik M, Nersesyan A, Waldherr M, Murbach M, Lah TT, Herold-Mende C, Collins AR, Knasmüller S. "Mobile phone specific electromagnetic fields induce transient DNA damage and nucleotide excision repair in serum-deprived human glioblastoma cells." *PLoS One*. 13(4):e0193677, 2018.

our specific questions, the responses directed Commission members to certain locations on websites for what turned out to be more general information on topics of public interest. The communications with these agencies are contained in [Appendix B](#).

Summary of Commission Meetings

The Commission met a total of 13 times over a period from September 2019 to October 2020. Unfortunately, due to the Covid-19 pandemic, all activity at the NH State House came to a halt from mid-March to mid-June this year. This meant that the Commission missed four meetings and thus heard from fewer experts on this topic than planned. It is important to stress that the Chair was planning to call additional witnesses from the scientific community as well as the telecommunication industry. When we resumed meeting, starting with one on July 1, all remaining meetings were conducted via Zoom. After our July 24th meeting, a work group consisting of seven members was formed to start formulating recommendations for the full Commission to consider. This work group met approximately every other week through the finalization of this report at the end of October. The table below summarizes the full Commission meeting dates and who the main speakers were.

#	Date	Major Topics and/or Guest Speakers
1	9/16/19	Organizational meeting
2	10/10/19	Electromagnetic Spectrum Physics Presentation Dr. Kent Chamberlin, Chair of UNH Electrical and Computer Engineering Department Presentation on Biological Effects of RF radiation Dr. Paul Heroux, Professor of Toxicology, McGill University
3	10/31/19	National Toxicology Program Study on RF-Radiation Michael Wyde, PhD Framing the Issue Video Frank Clegg, Former Microsoft Canada President
4	11/21/19	Non-Existence of RF-Radiation Biological Effects Argument Eric Swanson, PhD, University of Pittsburgh.
5	12/13/19	Reinventing Wires and 5G in Colorado Tim Schoechle, PhD, Colorado State University

6	1/10/20	Studies Showing RF-Radiation Biological Effects Devra Davis, PhD, MPH, Founder/President Environmental Health Trust (EHT) The Landscape Nationally and Internationally Surrounding RF-Radiation, Theodora Scarato, Executive Director EHT
7	2/14/20	What is 5G and What Do We Know About the Health Effects of 5G David Carpenter, MD, Director, Institute for Health and the Environment, University of Albany
<i>COVID-19 NH STATE HOUSE CLOSURE</i>		
8	7/1/20	13 Objections To 5G/4G Herman Kelting, PhD, Retired Las Vegas, NV
9	7/24/20	Around the table discussion of where we are and next steps. Established a work group to formulate recommendations.
10	8/31/20	Presentation of work group recommendations and discussion. Discussed that a minority report would be required.
11	9/22/20	Discussion and voting on first half of recommendations
12	10/8/20	Discussion and voting on second half of recommendations
13	10/27/20	Review and vote on final report.

There are extensive minutes of all of these meetings that are included at the end of this report in [Appendix O](#). In addition, the Commission has maintained a [webpage](#) on which is posted the various documents and links to information that it has collected during the course of its study, including many of the presentations provided during the meetings.

Questions Posed in HB 522

There were eight questions asked in the legislation creating the Commission. Research by the Commission has resulted in lengthy answers with supporting credits. With that we are showing the questions asked in the body of this report only, with the answer to each question shown in [Appendix C](#). The questions are as follows:

1. Why does the insurance industry recognize wireless radiation as a leading risk and has placed exclusions in their policies not covering damages by the pathological properties of electromagnetic radiation?
2. Why do cell phone manufacturers have in the legal section within the device saying keep the phone at least 5mm from the body?
3. Why have 1,000s of peer-reviewed studies, including the recently published U.S Toxicology Program 16-year \$30 million study, that are showing a wide

range of statistically significant DNA damage, brain and heart tumors, infertility, and so many other ailments, been ignored by the Federal Communication Commission (FCC)?

4. Why are the FCC-sanctioned guidelines for public exposure to wireless radiation based only on the thermal effect on the temperature of the skin and do not account for the non-thermal, non-ionizing, biological effects of wireless radiation?
5. Why are the FCC radiofrequency exposure limits set for the United States 100 times higher than countries like Russia, China, Italy, Switzerland, and most of Eastern Europe?
6. Why did the World Health Organization (WHO) signify that wireless radiation is a Group B Possibly Carcinogenic to Humans category, a group that includes lead, thalidomide, and others, and why are some experts who sat on the Who committee in 2011 now calling for it to be placed in the Group 1, which are known carcinogens, and why is such information being ignored by the FCC?
7. Why have more than 220 of the world's leading scientists signed an appeal to the WHO and the United Nations to protect public health from wireless radiation and nothing has been done?
8. Why have the cumulative biological damaging effects of ever-growing numbers of pulse signals riding on the electromagnetic sine waves not been explored, especially as the world embraces the Internet of Things, meaning all devices being connected by electromagnetic waves, and the exploration of the number of such pulse signals that will be created by implementation of 5G technology?

The answers to these questions have been embraced by the majority of the members of the Commission.

SUMMARY AND OBSERVATIONS

House Bill 522 established “a Commission to study the environmental and health effects of evolving 5G technology.” The Commission that was convened as a result of this legislation is comprised of thirteen members with backgrounds that include physics, engineering electromagnetics, epidemiology, biostatistics, occupational health, toxicology, medicine, public health policy, business, and law. The Commission also has representation from the telecommunications industry. The Commission began its work on September 16, 2019 and submitted this report on November 1, 2020.

The Commission recognizes that cellular and wireless communications is very important to the citizens of New Hampshire. The rollout of wireless services and new products in the industry can be key to enhancing public safety, economic opportunity, and healthcare. Regardless of the evidence presented and the risks associated with RF electromagnetic field effects, business and residents alike want 100% coverage and seamless connectivity. The majority of the Commission believes that some balance can be struck to achieve the benefits of technology without jeopardizing the health of our citizens.

To become acquainted with the issues relevant to 5G radiation exposure and health, the Commission heard from ten recognized experts in the fields of physics, epidemiology, toxicology, and public policy. All but the presenter representing the Telecommunications Industry (the transcript of that presentation can be found in the Commission’s minutes of Nov 21st) acknowledged the large body of peer-reviewed research that shows that the type of RF-radiation generated by wireless devices can have a deleterious effect on humans, especially children, as well as animals, insects, and vegetation (see [Appendix D](#)).

The Commission was unable to meet for four months due to the shutdown of the NH State House caused by COVID-19. While this loss of time did limit the number of presenters that could be accommodated, the majority of the Commission did not believe that additional presenters were necessary because the information provided by the ten experts was deemed sufficient.

5G is moving forward because of its potential benefits and because of assurances by federal regulatory agencies that 5G technology is not harmful. However, those

assurances have themselves come into question because of the thousands of peer-reviewed studies documenting deleterious health effects associated with cellphone radiation exposure. Most of the federal regulatory agencies' radiation exposure limits were established in the mid-1990s before the studies were carried out, so they did not take those studies into account when setting exposure limits. In addition, the initial exposure limits were developed at a time before wireless devices, and the radiation associated with them, became ubiquitous. Not only are wireless devices far more prevalent than in the past, but these radiating devices are typically carried in direct, or near direct, contact with peoples' bodies. Further, the total radiation exposure for individuals is compounded by the radiation from nearby sources, including others' devices, cell towers, wireless routers, Bluetooth devices, etc. Because of the large number of radiating devices in today's environments, exposure for people is many times greater than when radiation thresholds were established, and the nature of today's radiation (high-data-rate signals) has been shown to be more harmful than the lower-data-rate signals that were prevalent before.

The significant disconnect between the regulatory agencies' pronouncements that cellphone radiation is safe and the findings of thousands of scientific studies was one of the major issues that the Commission sought to address. The Commission is not alone in wrestling with this issue as many others (see [Appendix E](#)) have challenged the radiation thresholds specified. It is to be noted that the only country with higher radiation thresholds than the U.S. is Japan (see [Appendix F](#)), and a large number of independent scientists have concluded that the thresholds for Japan and the U.S. are unsafe.

A likely explanation as to why regulatory agencies have opted to ignore the body of scientific evidence demonstrating the negative impact of cellphone radiation is that those agencies are "captured" (see Harvard University publication entitled, "Captured Agency: How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates" linked in [Appendix G](#)). This report documents how the leadership roles in some agencies (the FCC in particular) are filled by individuals with strong industry ties and hence are more focused on industry interests than the health of citizens. As is shown in other sections of this report, federal legislation uses policy set by the regulatory agencies to wrest control of wireless facility placement from individuals, cities, and states. Consequently, some of the Commission's recommendations call for a

reassessment of the makeup and policies of federal regulatory agencies. Current policies in place by federal regulatory agencies (such as section 704 of the Telecommunications Act of 1996) are tailored to prevent local objections to cell tower siting that are based upon health or environmental concerns, and this leaves citizens with little legal recourse regarding equipment placement.

Industry projects that over 800,000 small cell towers⁵ will be necessary to implement 5G. Many are being erected in the public rights-of-way in New Hampshire neighborhoods and mounted on new poles, streetlights, and utility poles directly in front of homes. However, because of the rules currently in place, individuals and municipalities cannot use health or environmental concerns as a reason to object.

The majority of the Commission has endorsed the 15 recommendations presented in this report. These recommendations are not in prioritized order, and each should be given equal consideration. The objective of those recommendations is to bring about greater awareness of cell phone, wireless and 5G radiation health effects and to provide guidance to officials on steps and policies that can reduce public exposure. We also recommend partnering with our federal delegation to facilitate the reevaluation of radiation exposure guidelines and policies by federal agencies (i.e., the FCC, FDA, NASA, NOAA, FAA, EPA, etc.) to protect people, wildlife, and the environment from harmful levels of radiation.

Since the Commission could not reach full agreement on all that is contained in this report, the minority of the Commission has been given the opportunity to express its opinion as provided in the Minority Report.

⁵ The number of projected cell towers for 5G was taken from the CTIA website: “There are 154,000 cell towers today. To meet growing mobile data demands and win the Race to 5G Accenture projects we will need to install hundreds of thousands of small cells in the next few years. S&P Global Market Intelligence projects more than 800,000 small cells deployed by 2026.”

RECOMMENDATIONS

The Commission has heard from many experts on both sides of the argument concerning the health and environmental effects of 5G and RF-radiation in general; reviewed countless study reports; attempted to get direct answers to our specific questions from the FCC and other federal agencies to no avail; has become aware of a number of lawsuits against the FCC for not accounting for biological effects in the setting of their standards; is still not certain why the standards for acceptable RF-radiation are set so much higher in the United States than other industrialized nations; is concerned that the modulation of frequencies and the combined effect of “the soup” of RF-waves surrounding us today, which will likely increase with time; is aware that there is much research showing potential health risks and understands that much more research is required; is cognizant that our country historically has been beset by examples of products being declared safe only later to be proven unsafe; and is very aware that the World Health Organization and the whole insurance industry are hedging their bets against RF-radiation because of potential harm. Given these considerations, the majority of the Commission yields to the precautionary principle in formulating many of these recommendations. These recommendations cover a broad range of topics. One topic given much consideration had to do with liability from potential harm caused by small cell antennae placed on the public rights-of-way. A majority of the Commission could not agree upon a recommendation surrounding this topic.

RECOMMENDATION 1- Propose a resolution of the House to the US Congress and Executive Branch to require the Federal Communication Commission (FCC) to commission an independent review of the current radiofrequency (RF) standards of the electromagnetic radiation in the 300MHz to 300GHz microwave spectrum as well as a health study to assess and recommend mitigation for the health risks associated with the use of cellular communications and data transmittal. The Telecommunications Act of 1996 was adopted before the health risks and biological effects of RF-radiation to the human body were fully known to the scientific community as well as the public. The majority of the Commission believes that the FCC has not exercised due diligence in its mission to manage the electromagnetic environment by not setting exposure limits that protect against health effects. They have failed to support technical means and investigations aimed at reducing human exposures to electromagnetic radiation (EMR) in

telecommunications systems and optimize wireless modulations to reduce biological and health impacts. Commissioned research should study the health effects and should be conducted by an independent research organization with standards which have been mutually agreed to by all the stakeholders. The FCC shall then ensure that the findings and recommendations are adequately disseminated to the public.

RECOMMENDATION 2- Require that the most appropriate agency (agencies) of the State of New Hampshire include links on its (their) website(s) that contain information and warnings about RF-radiation from all sources, but specifically from 5G small cells deployed on public rights-of-way as well as showing the proper use of cell phones to minimize exposure to RF-radiation, with adequate funding granted by the Legislature. In addition, public service announcements on radio, television, print media, and internet should periodically appear, warning of the health risks associated with radiation exposure. Of significant importance are warnings concerning the newborn and young as well as pregnant women. Even without further study, there is evidence that the public should be warned of the potential dangers of RF-radiation and be told simple steps to lessen the risks of unnecessary exposure. [Appendix H](#) shows an example of a simple RF-radiation warning.

The website must provide an option for visitors to register their opinions about current FCC exposure guidelines. In particular, this registry should provide a convenient and formal mechanism for New Hampshire municipalities and residents to weigh in concerning the 1996 Telecommunications Act Section 704 that disallows using radiation-related health concerns as a reason to challenge cell phone tower siting. The primary use for the data collected on this registry will be to gauge the level of interest about RF-radiation exposure on the part of New Hampshire citizens.

RECOMMENDATION 3- Require every pole or other structure in the public rights-of-way that holds a 5G antenna be labeled indicating RF-radiation being emitted above. This label should be at eye level and legible from nine feet away. In the view of the Commission, the State of New Hampshire has the right to warn the public of potential harm of 5G antennae deployed in the public rights-of-way. Large cell towers all currently have fencing around them at their base to protect the public. This will not be the case with small cell towers or any pole with an

antenna on top in the public right-of-way. These public rights-of-way are the jurisdiction of our municipalities and not of the Federal Government. The Telecommunication Act of 1996 did not contemplate antennae being placed on the public rights-of way of municipalities. Thus, the State of New Hampshire has the right to warn the public by requiring the owners of these antennae to inform the public of potential harm from RF-radiation. See [Appendix I](#) for an example symbol.

RECOMMENDATION 4- Schools and public libraries should migrate from RF wireless connections for computers, laptops, pads, and other devices, to hard-wired or optical connections within a five-year period starting when funding becomes available. There is strong evidence that the younger the child the more susceptible they are to the negative impacts of RF-radiation. Hard-wired connections or optical wireless do not subject children to RF-radiation. The Commission is aware that school districts and public libraries have invested much in wireless infrastructure and that a movement to radiation-less connections would require additional investment of resources.

New optical networking solutions for the classroom and office spaces (such as LiFi) offer faster, healthier, and more secure connections than RF-based WiFi. This technology utilizes visible light, which organisms can withstand without any harm at far higher intensity levels (such as direct sunlight) than is required for data transmission. Such optical data transmission using visible light offers gigabit speed, as well as plug-and-play replacement of current RF WiFi routers. The optical wireless system can be incorporated in an upgrade to cost-efficient LED room lighting which can save schools and public libraries significant energy dollars.

The hard-wiring and/or optical projects should be completed within five years from when the federal funding (e.g., through the FCC's E-Rate program for telecommunications and IT in schools and public libraries) is procured.

RECOMMENDATION 5- Signal strength measurements must be collected at all wireless facilities as part of the commissioning process and as mandated by state or municipal ordinances. Measurements are also to be collected when changes are made to the system that might affect its radiation, such as changes in the software controlling it. Signal strength is to be assessed under worst-case

conditions in regions surrounding the tower that either are occupied or are accessible to the public, and the results of the data collection effort is to be made available to the public via a website. In the event that the measured power for a wireless facility exceeds radiation thresholds, the municipality is empowered to immediately have the facility taken offline. The measurements are to be carried out by an independent contractor and the cost of the measurements will be borne by the site installer. It is recognized that theoretical calculations show that existing FCC guidelines will be met by standard cell tower configurations. However, there are cases where the radiation from towers can be focused by buildings, terrain, and beamforming antennas, causing signal levels to be considerably higher than would be expected in theoretical calculations unless those effects are taken into account. Collecting field measurements provide the only valid approach for determining whether exposure guidelines have been met. It is to be noted that some municipalities (e.g., the town of Burlington, MA [1]) have ordinances requiring measurements at cell towers.

Federal law and NH law grant to municipalities the power to enact zoning rules regulating the placement of personal wireless service facilities within the geographic boundaries of the municipalities. Municipalities should be proactive in this area and, through the exercise of zoning power, establish where, how, and a process for compliance with existing FCC guidelines for signal strength in the surrounding coverage area. Municipalities should establish a hierarchy of siting values and compliance acknowledgements so that the siting most favored by the municipality is the easiest siting for the wireless applicant to obtain and, conversely, the siting which is least desirable should be the most difficult siting for the applicant to obtain. The zoning ordinance should lay out the compliance requirement as part of the zoning approval.

[1] Burlington, MA zoning Bylaw Wireless Facilities section 8.4.6.2 - “Annual RF emissions monitoring is required for all sites by an independent RF engineer to be hired with Planning Board approval and at the applicant’s expense. Test results will be submitted to the Town as soon as available, and not later than the close of the calendar year. Annual testing of electromagnetic emission shall be required to ensure continual compliance with the FCC regulations.”

Recommendation 6- Establish new protocols for performing signal strength measurements in areas around wireless facilities to better evaluate signal characteristics known to be deleterious to human health as has been documented through peer-reviewed research efforts. Those new protocols are to take into account the impulsive nature of high-data-rate radiation that a growing body of evidence shows as having a significantly greater negative impact on human health than does continuous radiation. The protocols will also enable the summative effects of multiple radiation sources to be measured.

Contemporary approaches to performing signal level measurements do not provide a means to evaluate signal impulsiveness or the contribution of multiple radiation sources because of equipment limitations. The measurement protocols proposed will employ wideband equipment that is currently available but is not typically used to measure compliance with radiation safety limits. References that address the deleterious effects of impulsive radiation on organisms are given in [Appendix J](#). The development of the proposed protocols should be funded by the appropriate federal agency (e.g., NSF, NIH, FCC, etc.) and should be facilitated by New Hampshire's federal delegation.

RECOMMENDATION 7- Require that any new wireless antennae located on a state or municipal right-of-way or on private property be set back from residences, businesses, and schools. This should be enforceable by the municipality during the permitting process unless the owners of residences, businesses, or school districts waive this restriction. Local public rights-of-way are under the jurisdiction of municipalities, and the Commission feels that municipalities should uphold the rights of individuals impacted by antennae. The Commission also supports the right of property owners to manage decisions on non-essential devices being placed in front of their property.

The Commission believes that it is important to prioritize citizen safety, particularly as 5G is an upgrade, rather than the provision of wireless service to unserved areas. Additional rationale for this recommendation is shown in [Appendix K](#).

RECOMMENDATION 8- Upgrade the educational offerings by the NH Office of Professional Licensure and Certification (OPLC) for home inspectors to include RF intensity measurements. Home inspectors currently operate as private contractors who may be hired by citizens or enterprises to measure such things as

radon, to collect water quality samples, or search for mold or insect damage. Home inspectors routinely supply test results to both their clients and government entities.

The majority of the Commission believes the public has the right to discover, on a voluntary basis, the RF power intensity related to radio frequencies at a property which they will be purchasing or renting before the transaction is closed. Also, the proprietors of publicly accessible venues may wish to reassure the public about the RF power intensity within their establishments, by posting the data collected by a state-approved inspector. In addition, such testing should be paid for by the party requesting it and the testing itself should be performed by a professional who owns or rents the test equipment and has met the state requirements for training of home inspectors regarding RF measurements.

The majority of the Commission proposes that home inspectors be offered training by NH OPLC on how to measure on-site peak and 24-hour average RF intensities. Measurements of frequencies and intensities will be performed using low-cost equipment (such as GQ-390 meters). [Description of existing home inspector training offered for radon, mold, etc. may be seen at <https://oplc.nh.gov/home-inspectors/index.htm>]

RECOMMENDATION 9- The State of New Hampshire should begin an effort to measure RF intensities within frequency ranges throughout the state, with the aim of developing and refining a continually updated map of RF exposure levels across the state using data submitted by state-trained home inspectors. The data should be collected in such a way as to identify geographic areas of notably high RF exposure, places where RF signal for wireless communication is inadequate (dead spots), and places where RF is unusually low (white spots) sought by people who wish to minimize their RF exposure. One possible use of this data will be buyers/renters of property or the public, in general, using benchmark values to make comparisons and make their own decisions based on their comfort level with RF exposure. After a while, an extensive New Hampshire RF database will exist to provide useful maps and data for future public health investigations. [Appendix L](#) outlines in more detail the technical aspects of this recommendation.

RECOMMENDATION 10- Strongly recommend all new cell phones and all other wireless devices sold come equipped with updated software that can stop the phone from radiating when positioned against the body. The Commission has been made aware that cell phones contain proximity sensors that will allow a cell phone to only radiate signals when a certain distance from the body, for example, held in the fingers or placed on a table. This does not change the functionality of the device, only the way it is used, specifically not held against the head or body. Implementation is a software update in the cell phone, as these phones already have a proximity detector to turn off the screen and soft keys when an obstacle is present. With this change, the screen and the RF circuit are automatically turned off. This removes the problems of brain cancers (glioblastomas and acoustic neuromas) and the issue of SAR limits for the industry. See [Appendix M](#) for more detailed references to the science behind this recommendation. Cell phones should come set with this inhibition, with instructions in the manual on how to disable it. There should be a soft button on the unit to easily re-enable the radiation inhibition, for example if the unit is handed to a child. In all cases, it should be easier to enable the restriction than to disable it. Cellular phones marketed specifically for children should stop radiating when positioned against the body under all circumstances. The installation of such proximity sensors is also encouraged in laptops and tablets.

RECOMMENDATION 11- Promote and adopt a statewide position that would strongly encourage moving forward with the deployment of fiber optic cable connectivity, internal wired connections, and optical wireless to serve all commercial and public properties statewide. The majority of the Commission believes that fiber optic transmission is the infrastructure of the future. When compared, RF wireless transmission lacks fiber optic characteristics: speed, security, and signal reliability while avoiding biological effects on humans and the environment.

The State should encourage partnerships between towns to make this happen and encourage our federal delegation to support grant money to assist with such deployments when it comes to funding fiber optic cable deployment, especially in rural locations.

RECOMMENDATION 12- Further basic science studies are needed in conjunction with the medical community outlining the characteristics of expressed clinical symptoms related to radio frequency radiation exposure. Further studies are just beginning to explore the quantum mechanical mechanisms which are the fundamental basis for understanding the biological changes occurring during the interaction of radio frequency radiation and molecules. These mechanisms can affect cells, tissues, and whole organs, as well as accumulate over time.

The majority of the Commission feels the medical community is in the ideal position to clarify the clinical presentation of symptoms precipitated by the exposure to radio frequency radiation consistent with the Americans with Disabilities Act (ADA) which identifies such a disability. The medical community can also help delineate appropriate protections and protocols for affected individuals.

All of these endeavors (basic science, clinical assessment, epidemiological studies) must be completely independent and outside of commercial influence.

RECOMMENDATION 13- Recommend the use of exposure warning signs to be posted in commercial and public buildings. In addition, encourage commercial and public buildings, especially healthcare facilities, to establish RF-radiation free zones where employees and visitors can seek refuge from the effects of wireless RF emissions. Many NH citizens report sensitivity to electromagnetic radiation emitted from devices used in the delivery of in-building cellular and fixed wireless services. A majority of the Commission suggests that owners of commercial and public buildings, especially healthcare facilities, voluntarily place signage at entrances concerning RF-levels and RF-free zones within these structures so those entering the building are aware.

RECOMMENDATION 14- The State of New Hampshire should engage agencies with appropriate scientific expertise, including ecological knowledge, to develop RF-radiation safety limits that will protect the trees, plants, birds, insects, and pollinators. The majority of the Commission understands that current federal safety limits were made with the intention of only protecting humans from short term effects, but not protecting flora or fauna from harm. The State of New Hampshire needs to ensure our natural environment and wildlife are protected by effective safety standards. Tree limbs, birds, and pollinators will be closer than

humans to 5G cell antennae and associated 4G densified infrastructure. In fact, the wireless radiation from cell antennae is very high in a plume surrounding the antennae. It could exceed FCC limits for several feet in this area, yet this is the exact area where leaves of trees, birds, and pollinators live. Thus, they may have higher exposures being in direct line of sight of wireless RF beams. When pollinators are impacted so are all forms of vegetation that depend on them for reproduction. Research on this issue is shown in [Appendix N](#).

RECOMMENDATION 15- The State of New Hampshire should engage our Federal Delegation to legislate that under the National Environmental Policy Act (NEPA) the FCC do an environmental impact statement as to the effect on New Hampshire and the country as a whole from the expansion of RF wireless technologies. Concern comes from the FCC projection that there will be numerous low orbit satellites and 5G small cell antennae, plus many additional macro towers required for these networks to function. The majority of the Commission is concerned that any new large-scale project that will densify antennae networks to this extent truly requires an environmental impact study. The NEPA statute requires that the agency consider environmental concerns in its decision-making process. NH should be provided documentation of such considerations. Until there is Federal action, NH should take the initiative to protect its environment.

MINORITY REPORT

The following members, being unable to agree with the majority of the Commission, endorse this Minority Report:

Senator James Gray, David Juvet, and Bethanne Cooley

Contrary to the position taken in the Recommendations section, the science related to radiofrequencies, wireless devices, and health is well studied and well known: The consensus of the U.S. and international scientific community is that there are no known adverse health risks from the levels of RF energy emitted at the frequencies used by wireless devices (including cellphones) and facilities (including small cells). Some of those who presented to the NH 5G Commission have sought to sow confusion, but the facts demonstrate otherwise.⁶ *First*, when setting limits for the RF emissions of wireless devices, the Federal Communications Commission (“FCC”) intentionally provided a significant safety margin—50 times below the threshold at which adverse effects have been observed in laboratory animals.⁷ And in its 2019 order, the FCC assessed the available science, including studies related to the safety of 5G networks, and based on the relevant scientific research, concluded that wireless devices and small cells are safe when they adhere to the FCC’s current RF exposure limits, as required by law. *Second*, numerous, independent analyses of peer-reviewed studies conducted over several decades by national and international organizations conclude that there are no known health risks to humans from RF

⁶ Commission discussions indicated that the Commission was comprised of many individuals who had preconceived opinions about the safety of RF devices and wireless technology in general. Due to many factors, experts in favor of wireless technology were cut short in participating. For example, an additional expert in favor of wireless technology was offered as a speaker during the summer and the Commission indicated no additional experts would be permitted. However, after that request was denied, an “expert” opposed to RF devices and wireless technology spoke at a subcommittee meeting of the majority. In addition, the Commission heard only a portion of expert Eric Swanson’s testimony and failed to consider in a balanced fashion the well-developed reviews of the science from the U.S. and international health and safety organizations. Thus, in this report we have cited those authorities even though the Commission did not include them as part of the formal record.

⁷ The threshold for adverse effects was set at the level at which heating caused a “disruption of observable behavior” in animals. See *Proposed Changes in the Commission’s Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields*, First Report and Order, Further Notice of Proposed Rulemaking, and Notice of Inquiry, 28 FCC Rcd. 3498, 3582 ¶ 236 (2013) (“FCC NOI”) (“exposure limits are set at a level on the order of 50 times below the level at which adverse biological effects have been observed in laboratory animals as a result of tissue heating resulting from RF exposure”); IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz, IEEE Std C95.1-2019, Annex B Sec. B.5.3.3 and Annex C Sec. C.2.1 (2019) (“Typically, the effect observed has been a decreased rate of responding or decreased reaction time.”).

energy emitted by wireless devices and infrastructure. Thus, the scientific consensus as evaluated by experts, international standard-setting bodies, and federal health and safety agencies is that wireless devices and base stations at the FCC's RF exposure levels is safe.

Given the scientific consensus, it is our opinion that the Recommendations exceed what a reasonable response should be to the evidence on this issue. This Minority Report purposely chose not to highlight each recommendation but instead highlights findings from federal agencies, including the FCC and the Food and Drug Administration (FDA), studies conducted by leading international and national health organizations, the IEEE and the scientific community at-large. It will also note the federal preemption issues associated with the Recommendations. Given the scientific consensus, it is our opinion that the Recommendations have no basis in scientific fact, are irresponsible, and will subject the state and any localities implementing these Recommendations to needless and expensive challenges that will drain time and resources from more important and credible priorities.

THE FCC SAFETY REGULATIONS

FCC limits govern RF energy from antennas used in all wireless devices including cellular transmissions from cellphones, cell towers, and 5G small cells. The FCC based these limits on recommendations from the scientific community and expert non-government organizations; the FCC limits currently cover frequencies from 100 kHz to 100 GHz, including the “millimeter wave” or “mmW” frequencies.⁸ These guidelines—based on internationally-recognized scientific organizations—set limits for the maximum amount of RF exposure from wireless devices and include a significant margin of safety.⁹ Specifically, the FCC has set its limit for a consumer device's Specific Absorption Rate—the measurement for RF emissions for consumer devices such as cellphones—“at a level on the order of *50 times below* the level at which adverse biological effects have been observed in laboratory animals.”¹⁰ The agency explained that this 50-fold factor can well

⁸ NPRM, 34 FCC Rcd at 11742 ¶ 120.

⁹ Testimony of Christopher C. Davis, Professor of Electrical and Computer Engineering, University of Maryland, *Hearing on S.B. 637 and S.B. 894 Before the Mich. H. Comm. on Energy Policy*, 2018 Leg., 99th Sess., at 4:17 (May 29, 2018) (“[Professor Davis Testimony](http://www.house.mi.gov/SharedVideo/PlayVideoArchive.html?video=ENER-052918-2.mp4)”), <http://www.house.mi.gov/SharedVideo/PlayVideoArchive.html?video=ENER-052918-2.mp4>.

¹⁰ FCC NOI at ¶236 (emphasis added).

accommodate a variety of variables such as different physical characteristics and individual sensitivities—and even the potential for exposures to occur in excess of [FCC] limits without posing a health hazard to humans.”¹¹ In reality, wireless devices and antennas typically operate well under FCC thresholds.¹²

Further, all wireless devices sold in the U.S. must go through a rigorous approval process to ensure they meet the science-based guidelines set by the FCC.¹³ The FCC’s testing regime requires cellphones to be tested under “the *most severe, worst-case (and highest power) operating conditions for all the frequency bands used in the USA for that cell phone*” to ensure that they meet the limits under everyday (non-worst-case) conditions.¹⁴ The FDA stands in full support of the adequacy of the FCC’s standards. The Director of the FDA’s Center for Devices and Radiological Health wrote in 2018: “[B]ased on our ongoing evaluation of this issue and taking into account all available scientific evidence we have received, ***we have not found sufficient evidence that there are adverse health effects in humans caused by exposures at or under the current radiofrequency energy exposure limits.***”¹⁵

HEALTH ORGANIZATIONS AND FDA STUDIES

International health organizations have also studied the effects of RF exposure and determined that there is no risk from RF emissions from modern wireless device usage. The World Health Organization (“WHO”) concludes “[c]onsidering the very low exposure levels and research results collected to date, there is no

¹¹ *Id.*; see also *Targeted Changes to the Commission’s Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields*, Resolution of Notice of Inquiry, Second Report and Order, Notice of Proposed Rulemaking, and Memorandum Opinion and Order, 34 FCC Rcd 11687, 11696 ¶14 (2019) (“Order”) (“[O]ur existing exposure limits are set with a large safety margin, well below the threshold for unacceptable rises in human tissue temperature.”).

¹² See Professor Davis Testimony (6:00-7:45) (discussing the 50-fold safety factor and typical emissions from small cells); Christopher C. Davis, Professor of Electrical and Computer Engineering, University of Maryland, *Hearing on S.B. 637 and S.B. 894 Before the Mich. H. Comm. on Energy Policy*, 2018 Leg., 99th Sess., Written Testimony at 2 (May 29, 2018), <http://www.wirelesshealthfacts.com/wp-content/uploads/2019/06/Davis-Testimony.pdf> (observing that “RF exposure levels from wireless base stations are invariably far below the FCC limits”).

¹³ See generally 47 C.F.R. § 1.1307; *id.* part 2 Subpart J; Order, 34 FCC Rcd at 11697-742 ¶¶ 17-118.

¹⁴ FCC, Consumer Guides, Health, Safety and Emergencies, *Specific Absorption Rate (SAR) for Cell Phones: What It Means for You* (emphasis in original), <https://www.fcc.gov/consumers/guides/specific-absorption-rate-sar-cell-phones-what-it-means-you> (last updated Oct. 15, 2019).

¹⁵ News Release, FDA, *Statement from Jeffrey Shuren, M.D., J.D., director of the FDA’s Center for Devices and Radiological Health on the recent National Toxicology Program draft report on radiofrequency energy exposure* (Feb. 2, 2018) (“Shuren Statement”), <https://www.fda.gov/news-events/press-announcements/statement-jeffrey-shuren-md-jd-director-fdas-center-devices-and-radiological-health-recent-national>.

convincing scientific evidence that the weak RF signals from base stations and wireless networks cause adverse health effects.”¹⁶ The WHO has also concluded that “research has not been able to provide support for a causal relationship between exposure to electromagnetic fields and self-reported symptoms, or ‘electromagnetic hypersensitivity’”.¹⁷ Likewise, both the United Kingdom Health Protection Agency Independent Advisory Group on Non-Ionizing Radiation and Swedish Council for Working Life and Social Research agree that RF exposure below guideline levels consistent with FCC limits do not cause health effects.¹⁸

The majority also justifies its recommendations by referencing “the problems of brain cancers (glioblastomas and acoustic neuromas) and the issue of specific absorption rate (SAR) limits for the industry.” Some have raised questions with respect to cancer and tumors, but experts in cancer have repeatedly found no link between mobile devices and cancer. For example, the National Cancer Institute reported that: “although many studies have examined the potential health effects of non-ionizing radiation from radar, microwave ovens, cell phones, and other sources, there is currently no consistent evidence that non-ionizing radiation increases cancer risk in humans.”¹⁹ Likewise, the American Cancer Society explained that the “RF waves given off by cell phone towers don’t have enough energy to damage DNA directly or to heat body tissues. Because of this, it’s not clear how cell phone towers might be able to cause cancer.”²⁰

Earlier this year, the FDA released a large-scale review of published literature to

¹⁶ WHO, *Electromagnetic fields and public health: Base stations and wireless technologies*, Backgrounder (May 2006), <https://www.who.int/peh-emf/publications/facts/fs304/en/>.

¹⁷ WHO, *Electromagnetic fields and public health: mobile phones*, Backgrounder (Oct. 8, 2014) (“WHO Mobile Phones Fact Sheet”), <https://www.who.int/news-room/fact-sheets/detail/electromagnetic-fields-and-public-health-mobile-phones>.

¹⁸ See Health Protection Agency Independent Advisory Group on Non-Ionizing Radiation, *Health Effects from Radiofrequency Electromagnetic Fields* (RCE-20), at 3 (Apr. 2012), https://webarchive.nationalarchives.gov.uk/20140722075005/http://www.hpa.org.uk/webc/HPAwebFile/HPAweb_C/1317133827077 (“The evidence suggests that RF field exposure below guideline levels does not cause acute symptoms in humans, and that people, including those who report being sensitive to RF fields, cannot detect the presence of RF fields.”); Anders Ahlbom, et al., *Radiofrequency Electromagnetic Fields and Risk of Disease and Ill Health: Research during the last ten years*, Swedish Council for Working Life and Social Research, at 6 (2012), <https://forte.se/app/uploads/sites/2/2015/11/10-y-rf-report.pdf> (“Extensive research for more than a decade ... has found no evidence for health risks below current exposure guidelines.”).

¹⁹ National Cancer Institute, *Cell Phones and Cancer Risk*, (Jan. 9, 2019) <https://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/cell-phones-fact-sheet>.

²⁰ American Cancer Society, *Cell Phone Towers* (emphasis omitted) (“ACS Cell Phone Towers”), <https://www.cancer.org/cancer/cancer-causes/radiation-exposure/cellular-phone-towers.html> (last visited October 7, 2020).

“assess any possible causal relationship between [RF energy] exposure and the formation of tumors.”²¹ After examining approximately 125 animal studies and 70 epidemiological studies, the FDA stated that “there are no quantifiable adverse health effects in humans caused by exposures at or under the current cell phone exposure limits.”²² As Dr. Jeffrey Shuren, Director of the FDA’s Center for Devices and Radiological Health, observed in 2018: “Even with frequent daily use by the vast majority of adults, we have not seen an increase in events like brain tumors.”²³ Courts too, after hearing extensive testimony, have determined that there is “no sufficiently reliable and relevant scientific evidence in support of either general or specific causation” that cellphone use caused the plaintiff’s brain cancer.²⁴ Dr. Otis Brawley, chief medical officer of the American Cancer Society, explained that “[t]he incidence of brain tumors in human beings has been flat for the last 40 years. ... That is the absolute most important scientific fact.”²⁵

THE SCIENCE AROUND EXPOSURES FROM 5G TECHNOLOGY

The majority has expressed concern with exposures from 5G technology using millimeter wave (“mmW”) bands and on the proliferation of small cell network architecture, and whether there are studies demonstrating that 5G does not create risks to human health.

Although 5G represents a new frontier for wireless communications, mmW frequencies do not. mmW frequencies are well understood by the international scientific community. The Institute of Electrical and Electronics Engineers (“IEEE”) has assembled a list of dozens and dozens of studies on mmW frequencies. The IEEE’s RF exposure standards over the last thirty years have cited 85 different mmW studies, the earliest was published in 1976 and the most recent in 2018.²⁶

²¹ FDA, *Review of Published Literature between 2008 and 2018 of Relevance to Radiofrequency Radiation and Cancer*, at 4 (Feb. 2020), <https://www.fda.gov/media/135043/download>.

²² *Id.* at 5.

²³ Shuren Statement.

²⁴ *Newman v. Motorola, Inc.*, 218 F. Supp. 2d 769 (D. MD 2002), *aff’d per curiam Newman v. Motorola, Inc.*, 78 Fed.Appx. 292 (4th Cir. 2003); *see also Murray v. Motorola, Inc.*, Memorandum Opinion and Order on Expert Witness Admissibility, Case No. 2002 CA 001371 A (Aug. 8, 2014).

²⁵ Luran Neergaard & Seth Borenstein, *Cross talk: Federal agencies clash on cellphone cancer risk*, Associated Press (Nov. 1, 2018), <https://apnews.com/4da5f1cdfd774af29143ff3f5ccffa0b>; *see also* IEEE Std C95.1-2019 at 16 n.8 (“The preponderance of epidemiologic evidence does not provide a sufficient basis for concluding that adult brain cancer is positively associated with mobile telephone use and, by implication, with RF exposures.”).

²⁶ CTIA, Resources, *Millimeter Wave Studies Cited by IEEE*, <http://www.wirelesshealthfacts.com/wp-content/uploads/2020/01/Millimeter-Wave-Studies.pdf> (last visited October 7, 2020).

Common equipment such as “airport scanners, automotive collision avoidance systems and perimeter surveillance radar security systems” all use mmW technology.²⁷

Acting responsibly, scientists and engineers continue to research RF exposure, including RF exposure with 5G technology. IEEE’s Committee on Man and Radiation just completed a comprehensive review of 5G systems concluding that, based on the evidence to date, “the likelihood of yet unknown health hazards at exposure levels within current limits to be very low, if they exist at all.”²⁸ The authors explained that “one can expect that exposures from 5G networks will not differ greatly from those associated with present generation networks” because, like “previous generations of cellular systems: [5G must] provide a signal that is strong enough to be useful within a given cell but not so strong as to cause interference to users in nearby cells.”²⁹ In other words, 5G base stations are limited in their power because of the potential for those emissions to cause interference with other base stations.

The American Cancer Society explained that “[w]hile [5G] RF waves are higher frequency (higher energy) than those used by older generations, they are still forms of non-ionizing radiation, so they still lack the ability to directly damage DNA.”³⁰ Further, “these higher frequency RF waves are less able to penetrate the body than lower frequency waves, so in theory they might be less likely to have any potential health effects.”³¹

5G will also take advantage of small cell network architecture, which results in more base stations operating at *lower* power levels. A recent overview of exposure from small cells determined that such “[f]ixed small cell wireless communication installations ... that operate in compliance with the regulations of the FCC will produce RF exposures well within the recommended exposure limits of the FCC, ICNIRP [International Commission on Non-Ionizing Radiation Protection], and IEEE.”³² Further, “[r]esearch to date does not provide a reliable

²⁷ Joan Conrow, *Three reasons why 5G is unlikely to cause harm*, Cornell Alliance for Science, (June 26, 2020), <https://allianceforscience.cornell.edu/blog/2020/06/three-reasons-why-5g-is-unlikely-to-cause-harm/>.

²⁸ *Id.*

²⁹ *Id.*

³⁰ *ACS Cell Phone Towers*

³¹ *Id.*

³² William H. Bailey, *Wireless 5G Radiofrequency Technology: An Overview of Small Cell Exposures, Standards and*

scientific basis to conclude that the operation of these facilities will cause or contribute to adverse health effects in the population.”³³

In March 2020, ICNIRP released updated, modernized guidelines that expressly cover the new frequencies that 5G will use. Announcing their release, ICNIRP Chairman, Dr. Eric van Rongen, advised that “[t]he most important thing for people to remember is that 5G technologies will not be able to cause harm when these new guidelines are adhered to.”³⁴ The FCC’s rules are also designed to protect health and safety, and prevent harm. Indeed, the FCC notes that “the possibility that a member of the general public could be exposed to RF levels in excess of the FCC guidelines is extremely remote.”³⁵

FEDERAL PREEMPTION

The majority makes several recommendations related to mandated warnings, labeling, compliance regulations, and zoning requirements based on health and safety concerns. These recommendations are not warranted based on the science discussed above, but are also not viable because federal law preempts state and local action that conflicts with the FCC’s determination that compliant devices and equipment are safe. Congress determined that the FCC should be the “central[] authority” for regulating communications in the U.S.³⁶ This charge includes the regulation of “the kind of apparatus to be used” for wireless radio communications and “the emissions” that such equipment may produce.³⁷ The FCC promulgated its RF exposure rules to ensure that they protect human health nationwide as technology evolves, relying on sound scientific research of government and other expert organizations.

The FCC acted in its role as, in the words of the Supreme Court, the “exclusive”

Science, at 7, Exponent (Apr. 2020), <http://www.wirelesshealthfacts.com/wp-content/uploads/2020/04/Bailey-5G-Whitepaper-4-15-20.pdf>.

³³ *Id.*

³⁴ Media Release, International Commission on Non-Ionizing Radiation Protection, *New Guidelines Released by the International Commission on Non-Ionizing Radiation Protection (ICNIRP)*, at 2 (Mar. 11, 2020), https://www.icnirp.org/cms/upload/presentations/ICNIRP_Media_Release_110320.pdf.

³⁵ FCC Consumer Guide, *Human Exposure to Radio Frequency Fields: Guidelines for Cellular Antenna Sites*, at 2 (Oct. 15, 2019), https://www.fcc.gov/sites/default/files/human_exposure_to_radio_frequency_fields_-_guidelines_for_cellular_antenna_sites.pdf.

³⁶ 47 U.S.C. § 151.

³⁷ *Id.* § 303(e).

arbiter in the “technical matters” of radio,³⁸ which includes control for any environmental effects, including, among other things, RF emissions.³⁹ For example, the FCC recognized that “very high levels of RF radiation can be harmful due to the ability of RF energy to heat biological tissue rapidly.”⁴⁰ Accordingly, the FCC’s rules *limit* RF exposure to humans “from *all* transmitting facilities, operations, and devices it regulates.”⁴¹

By way of background, the FCC first adopted RF exposure rules in the 1980s and has updated its rules in response to new scientific evidence.⁴² In 1996, Congress reaffirmed the FCC’s authority to set standards on RF emissions to provide “adequate safeguards of the public health.”⁴³ The FCC updated its RF exposure rules and relied on sound scientific research of government and other expert organizations. In particular, the FCC synthesized “submissions from the Environmental Protection Agency (“EPA”), the Food and Drug Administration (“FDA”), the Occupational Safety and Health Administration (“OSHA”), and the National Institute for Occupational Safety and Health (“NIOSH”).”⁴⁴ Several courts have examined and affirmed the FCC’s process to develop its RF exposure limits.⁴⁵ The Third Circuit observed that “the FCC is well positioned to solicit expert opinions and marshal the scientific data to ensure its standards both protect the public and provide for an efficient wireless network.”⁴⁶ And courts have confirmed that the agency has done so. For example, the D.C. Circuit upheld the

³⁸ *Head v. New Mexico Bd. of Exam’rs in Optometry*, 374 U.S. 424, 430 n.6 (1963) (observing that the “Commission’s jurisdiction over technical matters ... is clearly exclusive”).

³⁹ *Robbins v. New Cingular Wireless LLC*, 854 F.3d 315, 319-20 (6th Cir. 2017) (noting that Congress “delegate[ed] the task of setting RF emission levels to the FCC”). Of course, government entities can and have participated in the notice-and-comment aspect of the FCC’s rulemaking. See, e.g., *City of Boston, Massachusetts*, ET Docket No. 19-226 (filed June 17, 2020).

⁴⁰ FCC, RF Safety FAQ, *What Biological Effects Can Be Caused By RF Energy?*, <https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety#Q5> (last visited October 7, 2020).

⁴¹ Letter from Thomas M. Johnson, Jr., General Counsel, FCC, to Joseph H. Hunt, Assistant Attorney General, DOJ, N.D. Cal. No. C 19-05322 WHA, at 3 (Apr. 13, 2020) (citing 47 C.F.R. §§ 1.1307, 1.1310, 2.1091, 2.1093) (emphasis added), <https://docs.fcc.gov/public/attachments/DOC-363717A1.pdf>.

⁴² Letter from Thomas M. Johnson, Jr. General Counsel, FCC, to Joseph H. Hunt, Assistant Attorney General, DOJ, N.D. Cal. No. 3:15-cv-02529 EMC, at 3-5 (June 22, 2020) (examining the adoption and evolution of the Commission’s RF exposure rules).

⁴³ *Id.* at 4-5 (quoting H.R. Rep. No. 204, 104th Cong., 1st Sess. Pt. 1, at 94 (1995)).

⁴⁴ *Cellular Phone Taskforce v. FCC*, 205 F.3d 82, 88 (2d Cir. 2000).

⁴⁵ See, e.g., *id.* at 89 (rejecting an APA challenge to the FCC’s RF emissions decisions in the 1996 and 1997 proceedings).

⁴⁶ *Farina v. Nokia Inc.*, 625 F.3d 97, 126 (3d Cir. 2010); see also *id.* at 129 (confirming the Commission’s expertise to select an appropriate standard for RF limits).

agency's reliance on the views of expert agencies.⁴⁷

Every court since 2005 that has addressed this issue has held that federal law preempts state action that challenges the safety of wireless devices including zoning decisions based on safety concerns. The Telecommunications Act itself has an express preemption provision that prohibits state or local regulation of cellular equipment based on alleged health effects.⁴⁸ Courts have also struck down state law regulation of RF emissions from cell phones based on alleged health effects as impliedly preempted by the FCC's regulation.⁴⁹ And most recently, a United States District Court in the Ninth Circuit held that federal law preempts the City of Berkeley's Ordinance requiring warnings at the point of sale.⁵⁰ Preemption, therefore, would invalidate many of the Recommendations, which if adopted, would subject the state and localities to expensive challenges and litigation, and almost certain defeat.

The minority does not oppose individuals or communities who want to convert to technology that better suits their needs, so long as those decisions do not conflict with the FCC's goal of the rapid deployment of wireless technology. We also do not oppose communities providing individuals with information about how to reduce their exposure to RF emissions, consistent with what the FCC already does. While individuals should have access to equipment to measure the levels in apartments they are contemplating renting or homes they want to purchase, testing should not be mandated. Access to the testing or the equipment to conduct the test could be provided by various groups such as home inspectors, real estate agents and the county cooperative extension. Similarly, we do not agree to establishing a State funded oversight group or state funding of the measurement equipment. Nor do we believe, as a practical matter, that any of

⁴⁷ *EMR Network v. FCC*, 391 F.3d 269, 272-73 (D.C. Cir. 2004).

⁴⁸ 47 U.S.C. § 332(c)(7)(b)(iv); *See, e.g., Cellular Phone Taskforce*, 205 F.3d at 96 (interpreting the TCA to preempt a state and local government's power to regulate the placement, construction and modification of personal wireless services facilities on the basis of health effects of RF emissions); *Santa Fe Alliance for Public Health and Safety v. City of Santa Fe, N.M.*, 2020 WL 2198120, at *7 (D.N.M. May 6, 2020) (noting the TCA explicitly preempts states and local governments from considering environmental effects of RF emissions in siting decisions).

⁴⁹ *Farina*, 625 F. 3d at 129 ("there is no indication . . . that either Congress or the FCC traditionally viewed state regulation of RF emissions as a necessary complement to federal regulation"); *Murray v. Motorola, Inc.*, 982 A.2d 764, 777-778 (D.C. 2009) ("insofar as Plaintiffs' claims rest on allegations about the inadequacy of the FCC's RF radiation standard or about the safety of their FCC-certified cell phones, the claims are preempted under the doctrine of conflict preemption.").

⁵⁰ *CTIA – The Wireless Association v. City of Berkeley*, No. 15-cv-02529-EMC, 2020 WL 5576135 (N.D. Cal. Sept. 17, 2020) (holding the Berkeley Ordinance "overwarns and stands as an obstacle to the accomplishment of balancing federal objectives by the FCC.").

the Recommendations have any chance of receiving funding.

The minority feels strongly that the full body of literature of the science on wireless technology was ignored. Furthermore, the Commission neglected to carry out its mandate to study “...the advantages and risks associated with 5G technology.”⁵¹ Had this been done, the Commission would have been made aware of the significant economic and societal benefits that 5G is predicted to provide.⁵² The minority has strong concerns that should the majority’s conclusions regarding 5G safety – despite their complete odds with the overwhelmingly majority of verified scientific evidence – lead to the enactment of any of the majority’s recommendations, the citizens of New Hampshire would be deprived of the enormous benefits of wireless innovation in a time when wireless connectivity could not be more important.

⁵¹ See HB 522: http://gencourt.state.nh.us/bill_Status/billText.aspx?sy=2019&id=267&txtFormat=pdf&v=current (last visited October 14, 2020).

⁵² Accenture predicts deploying the next generation of high-speed 5G wireless networks could create up to three million jobs and add approximately \$500 billion to U.S. GDP through direct and indirect potential benefits, https://newsroom.accenture.com/content/1101/files/Accenture_5G-Municipalities-Become-Smart-Cities.pdf (last visited October 14, 2020).

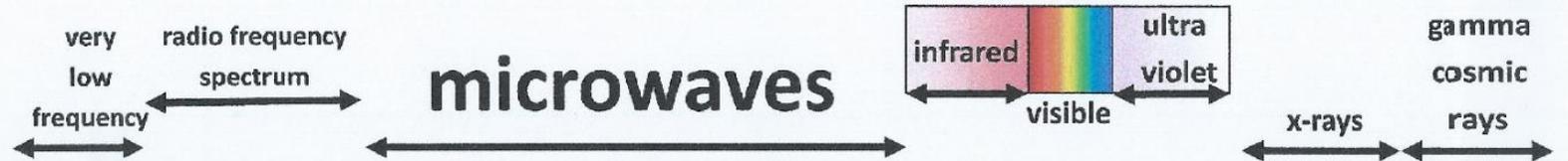
APPENDICES

THE ELECTROMAGNETIC SPECTRUM

SELF ELF VLF LF/ MF/ HF/ VHF/ UHF SHF EHF
 30KHz 3GHz 5GHz 300GHz 430-750THz 30PHz 3EHZ 300EHZ



$$f \text{ (frequency)} = \frac{C \text{ (speed of light)}}{\lambda \text{ (wavelength)}}$$



CRT monitors TV mobile AM/FM cell towers cell phones smart meters WiFi wireless smart meters microwave ovens cordless phones baby monitors satellites cordless phones sunlight medical x-rays radioactive sources

9 Terahertz (THz) 10-12 Petahertz (PHz) 10-15 Exahertz (EHZ) 10-18 Zetahertz (ZHz) 10-21 Yotahertz (YHz) 10-24

Appendix B

Correspondence with federal agencies

Correspondence between Councilwoman Denise Ricciardi, a member of the New Hampshire Commission on 5G, and Dr. Barrington and Dr. Hoover of the National Cancer Institute

Begin forwarded message:

From: NCI Information <nciinfo@nih.gov>

Date: July 30, 2020 at 2:51:16 PM EDT

To: New Bedford Councilmember Denise Ricciardi of the New Hampshire 5G Commission

Subject: Important questions that need to be answered.

Reply-To: "NCI Information" <nciinfo@nih.gov>

Subject: Important questions that need to be answered.

Response By Email (NCI Agent) (07/30/2020 11:51 AM)

Dear Ms. Ricciardi:

I received your follow-up inquiry requesting an answer to each question listed in your email. Please see below:

Councilmember Denise Ricciardi - Question 1. What is the National Cancer Institute opinion on the safety of 5G, 4G and cell towers? If you have one, please share your scientific documentation.

Response from the National Cancer Institute:

As a Federal research agency, the NCI is not involved in the regulation of radiofrequency telecommunications infrastructure and devices, nor do we make recommendations for policies related to this technology. The Food and Drug Administration (FDA) and the Federal Communications Commission (FCC) are the responsible federal agencies with authority to issue opinions on the safety of these exposures. Rather, NCI gathers and reviews published findings of well-conducted studies with a focus on cancer in humans in the medical literature and makes summaries available on its website and fact sheets.

[According to the FCC](#) certain agencies in the Federal Government have been involved in monitoring, researching or regulating issues related to human exposure to radiofrequency radiation. These agencies include the FDA, the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), the National Institute for Occupational Safe and Health (NIOSH), the National Telecommunications and Information Administration (NTIA) and the Department of Defense (DOD).

Councilmember Denise Ricciardi - Question 2. Has NCI staff done a systematic research review of the research on wireless radiation?

Response from the National Cancer Institute:

Experts at the NCI review the research on radiofrequency radiation and other types of non-ionizing radiation electromagnetic fields (EMFs) in order to maintain our fact sheets on these topics. Other federal agencies have the responsibility to formally review the research on these exposures, specifically the FDA and FCC.

Councilmember Denise Ricciardi - Question 3. What is the NCI opinion on the safety of cell phones? If you have one, please share your scientific documentation.

Response from the National Cancer Institute:

The FDA and FCC are the responsible federal agencies with authority to issue opinions on the safety of these exposures. As a Federal research agency, the NCI is not involved in the regulation of radiofrequency telecommunications infrastructure and devices, nor do we make recommendations for policies related to this technology.

The NCI gathers and reviews published findings of well-conducted studies in the medical literature on cell phones and cancer risk. The NCI fact sheet "[Cell Phones and Cancer Risk](#)" outlines the available evidence from human and animal studies regarding cancer risk and cell/mobile telephones. It includes references and the citations are at the bottom of the document.

Councilmember Denise Ricciardi - Question 4. Does the NCI recommend that parents teach their children to reduce exposure to cell phone radiation? Does the NCI think it is not necessary to take precautions and that information on reducing exposure is only for "concerned" people? Or does the NCI recommend all parents educate their children to reduce exposure and that they themselves reduce exposure to their children?

Response from the National Cancer Institute:

As noted above, the NCI does not make recommendations or issue guidelines. The fact sheet "Cell Phones and Cancer Risk" does include information from the FDA about ways cell phone users—children, teenagers or adults—can reduce their exposure to radiofrequency radiation. The FDA suggests that cell phone users reserve the use of cell phones for shorter conversations or for times when a landline phone is not available; and use a device with hands-free technology, such as wired headsets, which place more distance between the phone and the head of the user.

Councilmember Denise Ricciardi - Question 5. Did the NCI review in a systematic way the research on impacts of wireless and cell towers to trees and plants? If not, what agency is responsible for ensuring wireless signals are safe for trees and plants?

Response from the National Cancer Institute:

The NCI is not charged with researching the impact of wireless technology and cell towers on trees and plants. NCI is not aware of any Federal agency mandated to

ensure wireless signals are safe for trees and plants.

Councilmember Denise Ricciardi - Question 6. Did the NCI review in a systematic way the research on cell towers and how wireless antennas impact birds. If not, what agency is responsible for ensuring wireless signals are safe for birds?

Response from the National Cancer Institute:

The NCI is not charged with researching the impact of wireless technology and cell towers on birds. The NCI is not aware of any Federal agency mandated to ensure wireless signals are safe birds.

Councilmember Denise Ricciardi - Question 7. Did the NCI review in a systematic way the research on impact to bees and insects. If not, what agency is responsible for ensuring wireless signals are safe for insects and bees?

Response from the National Cancer Institute:

The NCI is not charged with researching the impact of wireless technology on bees and other insects. The NCI is not aware of any Federal agency mandated to ensure wireless signals are safe for bees and other insects.

Councilmember Denise Ricciardi - Question 8. Does the NCI only focus on cancer as a health effect?

Response from the National Cancer Institute:

Yes. In addition, by law, U.S. population-based cancer registries must collect information on benign brain tumors and the NCI fact sheet “Cell Phones and Cancer Risks” describes findings for meningioma, acoustic neuroma and other benign brain and central nervous system tumors.

Councilmember Denise Ricciardi - Question 9. The NCI does not present the findings of the NTP as “clear evidence of cancer” but simply states of the findings that “The primary outcomes observed were a small number of cancers of Schwann cells in the heart and non-cancerous changes (hyperplasia>) in the same tissues for male rats, but not female rats, nor in mice overall.” Why doesn’t the NCI present the findings of DNA damage on their webpage as it is published and was found in rats and mice. In addition cardiomyopathy was found. Why isn’t this presented on the NCI webpage?

Response from the National Cancer Institute:

The focus of the fact sheet “Cell Phones and Cancer Risk” is limited to cancer risk. As you noted, the fact sheet provided an overview of the primary outcomes found in the National Toxicology Program (NTP) study. These findings are reported on the [NTP website](#). A link to this information was included in the fact sheet for those who wish to know more about the NTP study.

Councilmember Denise Ricciardi - Question 10. The FDA disagrees with the National Toxicology Program findings of clear evidence of cancer. What is the NCI position on the determination of “clear evidence”?

Response from the National Cancer Institute:

The NCI does not comment on the cancer evaluation criteria of other organizations or how researchers use these definitions in their analysis. You may find useful [a critical evaluation of the NTP study](#) that was conducted by the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

Councilmember Denise Ricciardi - Question 11. Is there evidence that heating can cause cancer? That elevated temperatures can induce cancer?

Response from the National Cancer Institute:

There is [no current evidence that elevated temperatures or heating](#) is a risk factor for cancer.

Councilmember Denise Ricciardi - Question 12. Has the NCI reviewed in a systematic way the research on impacts to the nervous system?

Response from the National Cancer Institute:

The NCI fact sheet on “Cell Phones and Cancer Risk” provides a summary review of most epidemiologic studies of cell phone use and brain and other central nervous system tumors. Most of the studies are case-control studies. Details are provided on the three most impactful studies, including the 13-country, case-control Interphone study, the large national Danish cohort study, and the Million Women United Kingdom cohort study.

Councilmember Denise Ricciardi - Question 13. Does the NCI believe the current limits protect the public, children, pregnant women and medically vulnerable from health effects after long term exposure. Please provide documentation for each group, children, pregnant women and medically vulnerable that shows research ensuring safety.

Response from the National Cancer Institute:

The NCI does not regulate issues related to human exposure to radiofrequency radiation.

Councilmember Denise Ricciardi - Question 14. We know that the NCI is aware that cell phones can violate FCC SAR limits at body contact on high power. The FDA has written that because there is a safety factor. What is the safety factor for the SAR the FDA relies on? Do you know?

Response from the National Cancer Institute:

The FDA shares regulatory responsibilities for cell phones with the FCC. The FCC certifies wireless devices, and all phones that are sold in the United States must comply with FCC guidelines on radiofrequency exposure. The FDA also has the authority to take action if cell phones are shown to emit radiofrequency energy at a level that is hazardous to the user.

In addition, the FDA is responsible for protecting the public from harmful radiation

emissions from consumer products such as microwave ovens, televisions, and computer monitors. You may wish to contact the FDA's Center for Devices and Radiological Health's Office of Compliance at 301-594-4654, for information about SAR guidelines used in cell phones.

Councilmember Denise Ricciardi - Question 15. Will the NCI be taking action to inform the public about this? If not, please explain why not.

Response from the National Cancer Institute:

NCI staff are committed to regularly reviewing the published findings of well-conducted studies on cancer and making them available on a timely basis to the public through our online fact sheets. As noted above, the NCI continues to make this information available on its website [Cancer.gov](https://www.cancer.gov), the Institute's primary resource in informing the public about cancer research. The NCI gathers and reviews published findings of well-conducted studies in the medical literature on cell phones and cancer risk. The NCI fact sheet "Cell Phones and Cancer Risk" outlines the available evidence from human and animal studies regarding cancer risk and cell/mobile telephones. As also noted above, the NCI has conducted a review of the research on radiofrequency radiation

and other types of non-ionizing radiation electromagnetic fields (EMFs), available in the fact sheet

"Electromagnetic Fields and Cancer." NCI will continue to update these factsheets as new relevant studies are published in the peer-reviewed literature.

Our sister agencies, the FDA as well as the FCC, retain responsibility for reviewing guidance on safety concerns and informing the public if those circumstances change.

Councilmember Denise Ricciardi - Question 16. What actions specifically is the NCI doing now in regards to 5G and cell phone radiation in terms of research review?

Response from the National Cancer Institute:

As noted above, the NCI regularly reviews the published findings of studies on cancer and makes them available to the public.

Additionally, given the multi-year latency of brain tumors and most other solid tumors and the need to carefully consider the optimal study design, it would be premature to begin development of a protocol for studying the relation between 5G exposures and cancer risk before 5G systems are implemented. We are in close communication with other epidemiologists and dosimetrists working on radiofrequency exposures and cancer risks. We continue to carefully monitor research in this area.

Councilmember Denise Ricciardi - Question 17. Does the NCI evaluate the safety of 5G cell antennas? If so how? If not, what health agency is ensuring that 5G cell antennas are safe for people, wildlife and trees.

Response from the National Cancer Institute:

The FCC is responsible for developing guidelines for human exposure to

radiofrequency electromagnetic fields, which includes antennas.

Councilmember Denise Ricciardi - Question 18. Cell phones and wireless devices emit several types of nonionizing radiation in addition to radiofrequency radiation. For example the devices emit magnetic fields and when a pregnant woman holds a laptop on her lap the measured fields can be high even into the baby. What agency ensures safety related to extremely low frequency (ELF-EMF) electromagnetic fields- also nonionizing? Currently we have no federal limit, no federal guidelines and confirmed associations with cancer and many other health effects. Kaiser Permanente researchers have published several studies linking pregnant women's exposure to magnetic field electromagnetic fields to not only increased miscarriage and but also increased ADHD , obesity and asthma in the woman's prenatally exposed children. A recent large-scale study again found associations with cancer. Where is the NCI presentation of this research for the public?

Response from the National Cancer Institute:

As noted above, the FDA is responsible for protecting the public from radiation emissions from consumer products such as microwave ovens, televisions, and computer monitors. You may wish to contact the FDA's Center for Devices and Radiological Health's Office of Compliance at 301-594-4654, for information about research on this topic.

Our sister institute, [National Institute of Child Health and Human Development \(NICHD\)](#) another part of the NIH, investigates human development throughout the entire life process, with a focus on understanding disabilities and important events that occur during pregnancy. You may wish contact to the NICHD for information about radiofrequency radiation exposure and human development. NICHD can be contacted by email at NICHDInformationResourceCenter@mail.nih.gov <mailto:NICHDInformationResourceCenter@mail.nih.gov>.

NCI staff are committed to regularly reviewing the published findings of well-conducted studies on cancer and making them available on a timely basis to the public through our online fact sheets.

Councilmember Denise Ricciardi - Question 19. Will the NCI be sharing and recommending how to reduce ELF- EMF Exposure? Please clarify which US agency has jurisdiction over ELF-EMF exposures? Please clarify which US agency has authority to set limits for ELF-EMF exposures? As far as we know there is no limit in the USA for this type of exposure.

Response from the National Cancer Institute:

According to the fact sheet [“Electromagnetic Fields and Cancer”](#) sources of ELF-EMFs include power lines, electrical wiring, and electrical appliances such as shavers, hair dryers, and electric blankets.

As noted above, the NCI is not responsible for setting limits for ELF-EMF or any other exposure. Manufacturers of electronic radiation emitting products sold in the United States are responsible for compliance with the [Federal Food, Drug and Cosmetic Act \(FD&C Act\), Chapter V](#)

[Subchapter C - Electronic Product Radiation Control.](#)

The U.S. Congress created the National Institute of Environmental Health Sciences' (NIEHS) EMF Research and Public Information Dissemination (RAPID) Program in 1992 to study whether exposure to EMFs produced by the generation, transmission, or use of electric power posed a risk to human health. Although this program has ended, the NIEHS continues to study EMFs. For more information, please see [the NIEHS website](#).

Councilmember Denise Ricciardi - Question 20. Who are the NCI staff who have expertise on this issue at the NCI? What NCI staff is in the Interagency workgroup and where can we access the minutes and work of this group?

Response from the National Cancer Institute:

The content on the NCI's website [Cancer.gov](#) related to this topic is authored and maintained by NCI staff. The information on this site is science-based, authoritative, and up to date. Medical experts, cancer researchers, and editors review the content before it is published to the website.

Within the NCI, several research divisions conduct or fund extramural research to discover the genetic and environmental determinants of cancer and new approaches to cancer prevention, including the impacts of ionizing and nonionizing radiation. Epidemiologists also monitor cancer incidence trends for potentially relevant malignancies using U.S.-based cancer registries such as the North American Association of Central Cancer Registries and the Surveillance, Epidemiology, and End Results Program, and periodically review the scientific peer-reviewed literature in this area.

If you are compiling a list of EMF experts to contact, it is important to note that NCI scientists receive many requests for interviews or for advice with projects. All such inquiries should be directed to the NCI Office of Communications and Public Liaison through the NCI contact [page< mailto:https://www.cancer.gov/contact >](mailto:https://www.cancer.gov/contact) ; found on [Cancer.gov](#).

Councilmember Denise Ricciardi - Question 21. The FCC decided not to update their limits on wireless but the NCI did not submit an opinion to the FCC. Why not?

Response from the National Cancer Institute:

As noted above, the NCI does not make recommendations for policies on wireless technology.

Councilmember Denise Ricciardi - Question 22. Will the NCI be submitting an opinion to the FCC about the higher frequencies to be used in 5G?

Response from the National Cancer Institute:

As noted above, the NCI does not make recommendations for policies on wireless technology.

Councilmember Denise Ricciardi - Question 23. The American Cancer Society funded research by Yale that found cancer after cell phone radiation exposure. See it here [Thyroid Cancer, Genetic Variations, and Cell Phones Linked in New Yale School of Public Health Study](#) What is the NCI opinion?

Response from the National Cancer Institute:

NCI staff are committed to regularly reviewing the published findings of well-conducted studies on cancer and making them available on a timely basis to the public through our online fact sheets.

Councilmember Denise Ricciardi Question 24. Will you be updating your webpage with information on thyroid cancer and on genetic susceptibility as found by the Yale study?

Response from the National Cancer Institute:

Response from the National Cancer Institute: NCI staff are committed to regularly reviewing the published findings of well-conducted studies on cancer and making them available on a timely basis to the public through our online fact sheets.

Sincerely yours,
Bill Robinson
Office of Communications and Public Liaison National Cancer Institute

Customer By CSS Email (Denise Ricciardi) (07/19/2020 06:55 AM)

Hello,

You did not satisfy the commission. We requested you answer each question point by point. Not a paragraph that does NOT properly answer the questions.

Please go back and answer the questions number one provide the answer number two provide the answer and so on. Please expedite this request, it is urgent for commission.

Thank you,

Denise Ricciardi

Subject: Important questions that need to be answered.

Response By Email (NCI Agent) (07/16/2020 11:39 AM)

Dear Ms. Ricciardi:

Your email to Dr. Amy Berrington and Dr. Robert Hoover of the National Cancer Institute (NCI) regarding 5G has been forwarded to this office for reply. In your email, you asked questions about the status of research of the health and environmental effects of 5G (fifth-generation) wireless network technology on people and the natural world and which Federal agencies regulate this technology. We can offer information that you may find useful.

The NCI, part of the National Institutes of Health, is the Federal government's principal agency for cancer research and training. Part of the NCI's mission includes gathering and disseminating information about cancer, including risk factors, to the public and medical community through its website, fact sheets, and the NCI's Cancer Information Service (CIS). The fact sheets "Cell Phones and Cancer Risk" and "Electromagnetic Fields and Cancer" outline the available evidence from human and animal studies regarding cancer risk and cellular/mobile telephones and low- to medium-frequency electromagnetic fields.

The National Toxicology Program (NTP) investigated the health effects in animals exposed to radiofrequency (RF) radiation modulations used in 2G and 3G cell phones. According to the lead toxicologist of the studies, Michael Wyde, Ph.D., "5G is an emerging technology that hasn't really been defined yet. From what we currently understand, it likely differs dramatically from what we studied." This comment can be found in the NIH news release about the NTP final reports.

The NCI is committed to reviewing published findings of well-conducted studies in the medical literature and making them available to the public. Sometimes the results of a research study can yield inconsistent and even unanticipated results. Nonetheless, in this way, hypotheses are thoroughly evaluated.

As a Federal research agency, the NCI does not regulate RF electromagnetic field (EMF) exposure or establish guidelines. Within the Federal government, the U.S. Federal Communications Commission (FCC) authorizes or licenses most RF telecommunications services, facilities, and devices used by the public, industry and state and local governmental organizations. The FCC is required by the National Environmental Policy Act of 1969, among other things, to evaluate the effect of EMF emissions from FCC-regulated transmitters on the quality of the human environment. This includes cell phones and towers. The FCC Policy on Human Exposure web page includes links to several organizations that have recommendations for human exposure to EMF.

In addition, the U.S. Food and Drug Administration (FDA) shares regulatory responsibilities for cell phones with the FCC. Although cell phones can be sold without FDA clearance or approval, the agency monitors the effects the phones have on health. The FDA has the authority to take action if cell phones are shown to emit RF energy at a level that is hazardous to the user. The FDA recently provided an updated assessment of the current limits of RF energy based on the currently available scientific evidence (see Letter from the FDA to the FCC on Radiofrequency Exposure).

Sincerely yours,

Bill Robinson

Office of Communications and Public
Liaison National Cancer Institute

Customer By CSS Email (Denise Ricciardi) (07/10/2020 07:25 AM)

Hello,

I serve in New Hampshire on a health study commission. We need these questions answered each one, one by one.

Questions to Dr. Barrington and Dr. Hoover of the National Cancer Institute

1. What is the National Cancer Institute opinion on the safety of 5G, 4G and cell towers? If you have one please share your scientific documentation.
2. Has NCI staff done a systematic research review of the research on wireless radiation?
3. What is the NCI opinion on the safety of cell phones? If you have one please share your scientific documentation.
4. Does the NCI recommend that parents teach their children to reduce exposure to cell phone radiation? Does the NCI think it is not necessary to take precautions and that information on reducing exposure is only for "concerned" people? Or does the NCI recommend all parents educate their children to reduce exposure and that they themselves reduce exposure to their children?
5. Did the NCI review in a systematic way the research on impacts of wireless and cell towers to trees and plants? If not what agency is responsible for ensuring wireless signals are safe for trees and plants? 6. Did the NCI review in a systematic way the research on cell towers and how wireless antennas impact birds. If not, what agency is responsible for ensuring wireless signals are safe for birds?
7. Did the NCI review in a systematic way the research on impact to bees and insects. If not, what agency is responsible for ensuring wireless signals are safe for insects and bees?
8. Does the NCI only focus on cancer as a health effect?
9. The NCI does not present the findings of the NTP as "clear evidence of cancer" but simply states of the findings that "The primary outcomes observed were a small number of cancers of Schwann cells in the heart and non-cancerous changes (hyperplasia) in the same tissues for male rats, but not female rats, nor in mice overall." Why doesn't the NCI present the findings of DNA damage on their webpage as it is published and was found in rats and mice. In addition cardiomyopathy was found. Why isn't this presented on the NCI webpage?
10. The FDA disagrees with the National Toxicology Program findings of clear evidence of cancer. What is the NCI position on the determination of "clear evidence"?
11. Is there evidence that heating can cause cancer? That elevated temperatures can induce cancer?
12. Has the NCI reviewed in a systematic way the research on impacts to the nervous system?
13. Does the NCI believe the current limits protect the public, children, pregnant women and

medically vulnerable from health effects after long term exposure. Please provide documentation for each group, children, pregnant women and medically vulnerable that shows research ensuring safety.

14. We know that the NCI is aware that cell phones can violate FCC SAR limits at body contact on high power. The FDA has written that because there is a safety factor. What is the safety factor for the SAR the FDA relies on? Do you know?
15. Will the NCI be taking action to inform the public about this? If not, please explain why not.
16. What actions specifically is the NCI doing now in regards to 5G and cell phone radiation in terms of research review?
17. Does the NCI evaluate the safety of 5G cell antennas? If so how? If not, what health agency is ensuring that 5G cell antennas are safe for people, wildlife and trees.
18. Cell phones and wireless devices emit several types of non ionizing radiation in addition to radiofrequency radiation. For example the devices emit magnetic fields and when a pregnant woman holds a laptop on her lap the measured fields can be high even into the baby. What agency ensures safety related to extremely low frequency (ELF-EMF) electromagnetic fields- also non ionizing? Currently we have no federal limit, no federal guidelines and confirmed associations with cancer and many other health effects. Kaiser Permanente researchers have published several studies linking pregnant women's exposure to magnetic field electromagnetic fields to not only increased miscarriage and but also increased ADHD, obesity and asthma in the woman's prenatally exposed children. A recent large scale study again found associations with cancer. Where is the NCI presentation of this research for the public?
19. Will the NCI be sharing and recommending how to reduce ELF- EMF Exposure? Please clarify which US agency has jurisdiction over ELF-EMF exposures? Please clarify which US agency has authority to set limits for ELF-EMF exposures? As far as we know there is no limit in the USA for this type of exposure.
20. Who are the NCI staff who have expertise on this issue at the NCI? What NCI staff is in the Interagency workgroup and where can we access the minutes and work of this group?
21. The FCC decided not to update their limits on wireless but the NCI did not submit an opinion to the FCC. Why not?
22. Will the NCI be submitting an opinion to the FCC about the higher frequencies to be used in 5G.
23. The American Cancer Society funded research by Yale that found thyroid cancer after cell phone radiation exposure. See it here: <https://medicine.yale.edu/news-article/22332/> <https://protect-us.mimecast.com/s/K3TvCmZnOMf1oANt4> What is the NCI opinion?
24. Will you be updating your webpage with information on thyroid cancer and on genetic susceptibility as found by the Yale study?

Thank you for your cooperation.
Denise Ricciardi

Letters between Councilwoman Denise Ricciardi, a member of the New Hampshire Commission on 5G, and Dr. Shuren of the FDA

Note: The FDA did not answer the questions as asked and did not respond to the request to testify to the Commission

- June 23, 2020 Denise Ricciardi writes the FDA a detailed list of questions regarding their statements about cell phone radiation.
- Jul 15, 2020 FDA writes Denise Ricciardi a short two paragraphs that does not answer the questions.
- July 15, 2020 Denise Ricciardi writes back to the FDA stating that her questions are not answered.
- No additional answers have been provided by the FDA.
- March 2, 2020: The FDA also did not respond to the March 2020 request to testify to the 5G Commission.

July 15, 2020 Denise Ricciardi to the FDA

Hello,

This does not answer our specific numbered questions. Please go back and revisit the questions as requested.

Thank you,

Denise Ricciardi

On Jul 15, 2020, at 5:31 PM, Meister, Karen G <Karen.Meister@fda.hhs.gov> wrote:

July 15, 2020 Letter from FDA to Councilwoman Denise Ricciardi of the New Hampshire Commission on 5G

On Jul 15, 2020, at 5:31 PM, Meister, Karen G

Karen.Meister@fda.hhs.gov > wrote:

Dear Ms. Ricciardi,

Thank you for contacting the Food & Drug Administration (FDA) with your concerns regarding exposure to non-ionizing electromagnetic energy. Your inquiry was forwarded to the Intergovernmental Affairs (IGA) team in the Office of the Commissioner. We understand that you are a member of New Hampshire's "Commission to Study the Environmental and Health Effects of Evolving 5G Technology," and that you are gathering information.

As you may know, FDA shares regulatory responsibilities for cell phones with the Federal

Communications Commission (FCC). Under the law, FDA is responsible for, among other things: consulting with other federal agencies on techniques and programs for testing and evaluating electronic product radiation and collecting, analyzing, and making available scientific information on the nature and extent of the hazards and control of electronic product radiation. FDA's website provides information about cell phones, including the Agency's current assessment on the safety of exposure to non-ionizing electromagnetic fields. See <https://www.fda.gov/radiation-emitting-products/home-business-and-entertainment-products/cell-phones>. The website includes an update to the scientific evidence evaluated by FDA (see <https://www.fda.gov/radiation-emitting-products/cell-phones/scientific-evidence-cell-phone-safety>), as well as suggestions for those that may still be concerned about non-ionizing energy exposure (see <https://www.fda.gov/radiation-emitting-products/cell-phones/reducing-radio-frequency-exposure-cell-phones>).

FDA's doctors, scientists and engineers continually monitor the scientific studies and public health data for evidence that radio frequency energy from cell phones could cause adverse health effects. FDA also works with national and international health agencies to ensure the weight of scientific evidence is appropriately evaluated.

We hope this information is helpful to answer your questions. Best regards.

Karen Meister, J.D.
Acting Director, Intergovernmental Affairs
Senior Advisor, Office of Legislation
Office of the Commissioner/OPPLIA
U.S. Food and Drug Administration
(301) 796-8916 office
(240) 494-6228 (work cell)

From: "Shuren, Jeff" <Jeff.Shuren@fda.hhs.gov>
Date: June 24, 2020 at 4:28:49 PM EDT
To: Denise Ricciardi
Cc: OC Ombudsman <Ombuds@OC.FDA.GOV>, Patrick Abrami <abrami.nhrep@gmail.com>
Subject: RE: Important questions NEED to be answered for N.H. 5G health task commission

Thank you for reaching out to me. I have forwarded your questions to the FDA's Intergovernmental Affairs Staff who handles inquiries from State and local governments. I have included Karen Meister, their Acting Director, on this email, as well.

Best regards, Jeff

---Original Message

From: Denise Ricciardi
Sent: Tuesday, June 23, 2020 10:38 PM
To: Shuren, Jeff <Jeff.Shuren@fda.hhs.gov> <<mailto:Jeff.Shuren@fda.hhs.gov>>>
Cc: OC Ombudsman <Ombuds@OC.FDA.GOV> <<mailto:Ombuds@OC.FDA.GOV>>>;
Patrick Abrami <abrami.nhrep@gmail.com> <<mailto:abrami.nhrep@gmail.com>>>

Subject: Important questions NEED to be answered for N.H. 5G health task commission

Dear Dr. Shuren,

We would appreciate an answer to these questions regarding cell phone radiation. If you could number them one by one it would help with clarity of your response.

Regarding the FDA's report ["Review of Published Literature between 2008 and 2018 of Relevance to Radiofrequency Radiation and Cancer"](#)

1. Why did the FDA only focus on cancer as a health effect?
2. The FDA said of the National Toxicology Program findings that the FDA was unsure if the tumors were a causal effect or if these results were "due to weakening of the immune response due to animal stress from cyclic heating and thermoregulation." Does the FDA think that cancer could be an effect of whole body heating, that cancer is a thermally induced effect? If so, what other studies show that heating causes cancer?
3. Did the FDA review in a systematic way the research on impacts to the nervous system?
4. At the Commission, a study on how millimeter waves interact with insects was discussed. Did the FDA review in a systematic way the research on impact to bees, insects and pollinators?
5. Did the FDA review in a systematic way the research on impact to trees and plants?
6. Did the FDA review in a systematic way the research on impact to birds.
7. If the FDA did not investigate impacts to insects or trees, what US agencies have done so?
8. The FDA website page [Scientific Evidence for Cell Phone Safety](#) has a section entitled "No New implications for 5G". Does the FDA believe that 5g is safe or that 5G has the same health issues as 3 and 4G? What is the FDA opinion on the safety of wireless?
9. What is the FDA opinion on FCC limits in terms of long term health effects. Does the FDA believe the current limits protect the public, children, pregnant women and medically vulnerable from health effects after long term exposure.
10. The FDA is aware that cell phone can violate FCC SAR limits at body contact on high power. The FDA has written that because there is a safety factor. What is the safety factor for the SAR the FDA relies on. At what SAR level above FCC limits will the FDA intervene?
11. What actions specifically is the FDA doing now in regards to 5G and cell phone radiation in terms of research review? How often will the FDA be releasing reports?
12. Will the FDA be evaluating the safety of 5G cell antennas? If so how? If not, what health agency is ensuring that 5G cell antennas are safe for people, wildlife and trees.
13. Cell phones and wireless devices emit several types of non ionizing radiation in addition to radiofrequency radiation. For example the devices emit magnetic fields and when a pregnant woman holds a laptop on her lap the measured fields can be high even into the baby. What agency ensures safety related to extremely low frequency (ELF-EMF)

electromagnetic fields- also non ionizing? Currently we have no federal limit, no federal guidelines and confirmed associations with cancer and many other health effects. Kaiser Permanente researchers have published several studies linking pregnant women's exposure to magnetic field electromagnetic fields to not only [increased miscarriage](#) and but also [increased ADHD](#), [obesity](#) and [asthma](#) in the woman's prenatally exposed children. A [recent large-scale study](#) again found associations with cancer. Please clarify which US agency has jurisdiction over ELF-EMF exposures?

14. Will the FDA be initiating any research studies on 5G and health effects?

We as a health study commission on 5G take these duties very seriously. We are unbiased and we are seeking all answers and facts. We are requiring your answers to the above questions.

Thank you,
Denise Ricciardi
Committee Member appointed by Governor Sununu.

Additional Emails related to the questions:

From: "Meister, Karen G" <Karen.Meister@fda.hhs.gov>

Date: July 14, 2020 at 2:12:10 PM EDT To: Denise Ricciardi

Subject: FW: Important [External]

Hi Ms. Ricciardi-

We apologize for not responding sooner. Dr. Shuren forwarded your inquiry to our office because the Intergovernmental Affairs staff in the Office of the Commissioner handles inquiries from state and local governments like yours. We hope to get you a response very shortly. Thank you for your patience.

Karen
Karen Meister, J.D.
Acting Director, Intergovernmental Affairs
Senior Advisor, Office of Legislation
Office of the Commissioner/OPPLIA
U.S. Food and Drug Administration
(301) 796-8916 office
(240) 494-6228 (work cell)
(703) 201-6952 (personal cell- I will call you back on work phone)

Original Message

From: Denise Ricciardi
Sent: Tuesday, July 14, 2020 9:08 AM
To: Shuren, Jeff <Jeff.Shuren@fda.hhs.gov>
Cc: Patrick Abrami
Subject: Important

We have received no answers for our questions for the 5G health study commission in New Hampshire. Please advise!

Original Message

From: Denise Ricciardi

To: CDRHSpeakerLiaison@fda.hhs.gov <CDRHSpeakerLiaison@fda.hhs.gov>;
jeff.shurren@fda.hhs.gov
lyndsay.loud@fda.hhs.gov
<jeff.shurren@fda.hhs.gov>

Cc: Patrick.Abrami@

Subject: Study commission HB522 New Hampshire

Sent: Wed, Mar 4, 2020 2:43 pm

Good afternoon,

Governor Sununu in the State of New Hampshire has tasked a group of us to study the health effects of the 5G rollout.

We are composed of a wide variety of talents. Including Physicians, toxicologists, scientists, epidemiologists, physicists, engineers, the telecom industry and more.

We have been meeting since last October and have had many experts provide testimony.

To complete our findings in an unbiased fashion. It is essential to have a qualified member of the FDA and the FCC present to our commission.

We are making history in New Hampshire. Many other States are watching. Our results will have a profound effect.

When can we count on your participation on such an important issue.

Thank you,
Denise Ricciardi

Appendix C

Answers to the specific questions posed by HB 522

1. Why does the insurance industry recognize wireless radiation as a leading risk and has placed exclusions in their policies not covering damages caused by the pathological properties of electromagnetic radiation?

As [shared](#) with the Commission, insurers rank 5G, wireless, and electromagnetic radiation as high risk based on their white papers which compare the risk to asbestos where it may take decades to know the full extent of health impacts.

Scarato shared a 2019 report by Swiss Re Institute⁵³ which classifies 5G mobile networks as an "off-the-leash" "HIGH" risk, meaning a high-impact emerging risk that will affect property and casualty claims in more than three years' time. The Swiss Re report states on page 29:

To allow for a functional network coverage and increased capacity overall, more antennas will be needed, including acceptance of higher levels of electromagnetic radiation. In some jurisdictions, the rise of threshold values will require legal adaptation. Existing concerns regarding potential negative health effects from electromagnetic fields (EMF) are only likely to increase. An uptick in liability claims could be a potential long-term consequence.

Potential impacts:

- Cyber exposures are significantly increased with 5G, as attacks become faster and higher in volume. This increases the challenge of defense.
- Growing concerns of the health implications of 5G may lead to political friction and delay of implementation, and to liability claims. The introductions of 3G and 4G faced similar challenges.

⁵³ Swiss Re Institute, [New Emerging Risk Insights](#), 2019

- Information security and national sovereignty concerns might delay implementation of 5G further, increasing uncertainty for planning authorities, investors, tech companies and insurers.
- Heated international dispute over 5G contractors and potential for espionage or sabotage could affect international cooperation, and impact financial markets negatively.
- As the biological effects of EMF in general and 5G in particular are still being debated, potential claims for health impairments may come with a long latency.

A Business Insurance analysis⁵⁴ also examined mass tort exposures that may have the potential to cause major difficulties for commercial policyholders and their insurers. It includes workers' overexposure to radio frequency waves from rooftop wireless transmitters as a potential future claim and states that research "has shown biological effects from lower-level 'nonthermal' exposure, and people exposed at lower levels have reported headache, dizziness, nausea, mood disorders, mental slowing, and memory loss." Most insurance plans do not cover electromagnetic fields (EMF) and they have "electromagnetic field exclusions."

For example the [California State University Risk Management Authority \(CSURMA\) Self Insured Program](#) states:

We will not pay for loss or damage caused by or resulting from any of the following:

...

Artificially generated electrical, magnetic or electromagnetic energy that damages, disturbs, disrupts or otherwise interferes with any: (1) Electrical or electronic wire, device, appliance, system or network; or (2) Device, appliance, system or network utilizing cellular or satellite technology. But if fire results, we will pay for the loss or damage caused by that fire if the fire would be covered under this coverage form. For the purpose of this exclusion, electrical, magnetic or electromagnetic energy includes but is not limited to: (1) Electrical current, including arcing; (2) Electrical charge produced or conducted

⁵⁴ BusinessInsurance.com, "[The Next Asbestos: Five emerging risks that could shift the liability landscape](#)," May 13, 2011.

by a magnetic or electromagnetic field; (3) Pulse of electromagnetic energy; or (4) Electromagnetic waves or microwaves.

Even AT&T Mobile Insurance⁵⁵ excludes loss from pollutants. Their policy states, "Pollutants" means: Any solid, liquid, gaseous, or thermal irritant or contaminant including smoke, vapor, soot, fumes, acid, alkalis, chemicals, artificially produced electric fields, magnetic field, electromagnetic field, sound waves, microwaves, and all artificially produced ionizing or non- ionizing radiation and waste."

Crown Castle states in their [2020 Annual Report](#):

If radio frequency emissions from wireless handsets or equipment on our communications infrastructure are demonstrated to cause negative health effects, potential future claims could adversely affect our operations, costs or revenues.

The potential connection between radio frequency emissions and certain negative health effects, including some forms of cancer, has been the subject of substantial study by the scientific community in recent years. We cannot guarantee that claims relating to radio frequency emissions will not arise in the future or that the results of such studies will not be adverse to us.

Public perception of possible health risks associated with cellular or other wireless connectivity services may slow or diminish the growth of wireless companies, which may in turn slow or diminish our growth. In particular, negative public perception of, and regulations regarding, these perceived health risks may slow or diminish the market acceptance of wireless services. If a connection between radio frequency emissions and possible negative health effects were established, our operations, costs, or revenues may be materially and adversely affected. We currently do not maintain any significant insurance with respect to these matters.

⁵⁵ [AT&T Mobile Insurance Policy](#), 2014, p. 4

Wireless companies from AT&T⁵⁶ to Nokia to T-Mobile to Verizon Wireless have issued similar warnings⁵⁷ to their own shareholders.

Contained in [Vodafone's 2018 Annual Report](#) are the following statements: “What is the risk? Electro-magnetic signals emitted by mobile devices and base stations may be found to pose health risks, with potential impacts including: changes to national legislation, a reduction in mobile phone usage or litigation” and “EMF health related risks - EMF found to pose health risks causing reduction in mobile usage or litigation.” The report also included EMF is a “Principal Risk” rated as high in the graphic on pages 38 – 39.

Additional Insurance Reports that Rank Wireless and Electromagnetic Fields as “High Risk”

- 2016 Austrian Accident Insurance Institute (AUVA) ATHEM Report 2 [“Investigation of athermal effects of electromagnetic fields in mobile communications.”](#)
- 2014 [Swiss Re SONAR Report: New emerging risk insights.](#)
- 2013 AM Best Briefing, [Emerging Technologies Pose Significant Risks with Possible Long-Tail Losses.](#)
- 2011 Business Insurance White Paper, [“The Next Asbestos: Five emerging risks that could shift the liability landscape.”](#)
- 2011 Austrian Accident Insurance Institute (AUVA) ATHEM Report 1, [Investigation of athermal effects of electromagnetic fields in mobile radio areas](#) in German
- [2010 Lloyd’s of London Report on Electromagnetic Fields](#)
- 2009 Austrian Accident Insurance Institute Report on Health Risks from Cell Phone Radiation [“Nonthermal Effects of Electromagnetic Radiation in the Cell Phone Frequency Range.”](#)
- 2011 Business Insurance Article [“Geisel, Roseanne White. “Insurers exclude risks associated with electromagnetic radiation.”](#)

⁵⁶ [AT&T 2016 Annual Report](#)

⁵⁷ EHTrust.org, [“Corporate Company Investor Warnings In Annual Reports 10k Filings Cell Phone Radiation Risks.”](#)

2. Why do cell phone manufacturers have in the legal section within the device saying keep the phone at least 5mm from the body?

5G will have multiple antennas for 5G as well as 4G, Wi-Fi, Bluetooth, and other technology. All of these antennas emit wireless radiation. Even if you are not on the phone, it has continuous emissions.

Phones are premarket tested for cell phone radiation exposures with a separation distance from the phone and the body phantom. This legal section states the exact separation distance the manufacturers used when testing the phone for compliance. As the 2012 GAO Report "[Exposure and Testing Requirements for Mobile Phones Should Be Reassessed](#)" states, "The specific minimum separation distance from the body is determined by the manufacturer. In addition, the U.S. government does not perform independent cell phone compliance testing, allowing each manufacturer to submit their own SAR testing results to the FCC."

If phones are used in positions closer than this manufacturer's stated distance, the cell phone user could potentially receive excessive cell phone radiation SAR levels which violate the FCC regulatory limits. Several reports in the US and internationally have confirmed that when phones are tested at body contact, the measured SAR will exceed FCC limits.^{58, 59, 60, 61} Theodora Scarato presented this information to the Commission including an [analysis](#) by Professor Om Gandhi which examined [data](#) from 450 cell phone models from the French government agency, ANFR, the national radiation assessment bureau, indicating that phones can emit 11 times over the US FCC limit and 3 times over European/ICNIRP limits.

FCC Does Not Require Body Contact Tests for Cell Phone Radiation

As stated in the 2012 [GAO report](#), "Some consumers may use mobile phones against the body, which FCC does not currently test, and could result in RF energy exposure higher than the FCC limit." The GAO report also directed the FCC to review their cell phone testing protocol because they found these protocols could

⁵⁸ Gandhi, O. P. (2019). "[Microwave Emissions From Cell Phones Exceed Safety Limits in Europe and the US When Touching the Body.](#)" *IEEE Access*, 7, 47050-47052. doi:10.1109/access.2019.2906017

⁵⁹ Gandhi, Om P., and Gang Kang. "[Inaccuracies of a plastic pinna SAM for SAR testing of cellular telephones against IEEE and ICNIRP safety guidelines.](#)" *IEEE Transactions on Microwave Theory and Techniques* 52.8 (2004).

⁶⁰ Gandhi, Om P. "[Yes the children are more exposed to radiofrequency energy from mobile telephones than adults.](#)" *IEEE Access* 3 (2015): 985-988.

⁶¹ Kang, Gang, and Om P. Gandhi. "[SARs for pocket-mounted mobile telephones at 835 and 1900 MHz.](#)" *Physics in Medicine and Biology* 47.23 (2002): 4301.

allow for consumers to receive SAR levels that possibly exceed the "on the body" exposure guidelines.

Cell phone manufacturers are not required by the FCC to test cell phones for cell phone radiation compliance in positions which mimic direct contact between the phone and the body. In the USA, manufacturers can set distances of up to 25 mm when they perform SAR radiation testing for their phones and they are still within the law.

In contrast, in Europe the law has changed to ensure phones are tested at least at 5 mm and no more. This happened after France ANFR released radiation measurements for hundreds of cell phones tested independently by the government of France. The ANFR found the radiation levels were so high that most tested phones exceeded European cell phone radiation limits, showing radiation levels up to three times higher than the limits! ANFR has posted the [information](#) on their website.

Several phone models have been taken off the European market or software updated to reduce the radiofrequency radiation. The first withdrawal of cell phones from the market due to cell phone radiation levels dates back to April 2018, with the 100,000 Hapi 30 phones marketed by Orange, followed by the Neffos X1 TP902 (May 2018), the Echo Horizon Lite (Oct 2019), and the [announcement](#) on May 20 of the withdrawal of the Razer Phone 2 devices.

After the release of the ANFR tests that found phones violated limits in body contact positions, a new [European Directive 2014/35/UE called RED](#), applicable from June 2016, changed the regulations so that now all phones in the European Union are SAR tested at a distance no greater than 5 mm.

Furthermore, the French ministries of Health, Ecology and Economy issued a [joint press release](#) on October 25, 2019⁶² announcing France will ask the European Commission to further strengthen the SAR tests requirements to be carried out in a body contact position of 0mm from the body phantom. This would ensure that tests mimic the way people use cell phones today, touching the body.

⁶² Buzyn A. "[The Government is taking action to limit exposure to the emissions of certain mobile phones and to better inform the public.](#)" *Ministère Des Solidarités Et De La Santé*. Published 2019. Accessed July 8, 2020.

FCC SAR Limits

The FCC regulates RF energy emitted from FCC-regulated transmitters and has implemented a certification program to ensure that all mobile phones and wireless devices sold in the United States comply with the agency's limit on RF radiation exposure.

Before a cell phone model is permitted to go on the market for sale, its manufacturer performs Specific Absorption Rate (SAR) tests to evaluate the radiation levels. SAR values are expressed in terms of watts per kilogram (W/kg) and are intended to measure the amount of cell phone radiofrequency radiation absorbed by the body when using a wireless device.

Cell Phone Radiation SAR Limits in the USA

The FCC and Health Canada limit for cell phone radiation exposure to the public from cellular telephones is a SAR level of 1.6 watts per kilogram averaged over 1 gram of tissue. For extremities such as the wrists, ankles, hands, ears, and feet, the allowable SAR limit is much higher and is 4.0 W/kg averaged over 10 grams of tissue.⁶³

Image from FCC Presentation⁶⁴



SAR

Occupational/Controlled Exposure Limits (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

General Population/Uncontrolled Exposure Limits (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

Whole-Body SAR is averaged over the entire body.
Partial-body SAR is averaged over any 1 g of tissue in the shape of a cube.
SAR for hands, wrists, feet and ankles is averaged over any 10 g of tissue in the shape of a cube.

SAR limits are not applicable above 6.0 GHz; MPE limits for field strength and power density should be applied. Categorical exclusion of routine MPE evaluation for mobile transmitters does not apply to portable devices operating above 6.0 GHz.

October 2005 TCB Workshop 8

⁶³ [Radio Frequency Safety](#) | Federal Communications Commission. Accessed July 8, 2020.

⁶⁴ https://transition.fcc.gov/oet/ea/presentations/files/oct05/RF_Exposure_Concepts_Support_KC.pdf

There also is an occupational SAR limit for cell phones, allowing much higher exposures. The US FCC occupational limit is a SAR level of 8 watts per kilogram averaged over 1 gram of tissue. For extremities such as the wrists, ankles, hands, ears, and feet, the allowable SAR limit is much higher and is 10.0 W/kg averaged over 10 grams of tissue.

According to the FCC⁶⁵ the “occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure.”

Thus, the manufacturer's recommended distance for cell phones is a defined number of millimeters. The specific distances for each phone varies and can be found in the cell phone's instruction/user manual. Furthermore, the recommended distance for wireless laptops, Wi-Fi routers, smart security systems, smart speakers and printers is generally 20 centimeters (approximately 8 inches) as stated in the user manual. The FCC states that “mobile devices are transmitters designed to be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.”

The CTIA has argued that “there is no reliable evidence proving that current testing protocols fail to ensure compliance with RF standards.” This is stated in [the CTIA submission to the US Federal Communications Commission](#) regarding the FCC Proceeding on Human Exposures to Radiofrequency Radiation. CTIA also stated, “a zero-measuring requirement would not accurately mimic real usage or increase safety.”

The French data release refutes these CTIA and FCC statements because they found SAR levels were in violation of limits when phones were tested in body contact positions at highest power levels.

⁶⁵ Chan K. [Overview of RF Exposure Overview of RF Exposure Concepts and Requirements Concepts and Requirements](#). http://grouper.ieee.org/groups/scc34/sc2/wg1/appr_memo.html. Accessed July 8, 2020.

Examples of the Manufacturer's Instructions

Here are some examples of the radiofrequency statement for phones as well as other wireless devices people use every day.

Samsung Health and Safety Information	“Body-worn operations are restricted to belt-clips, holsters or similar accessories that have no metallic component in the assembly and must provide at least 1.5cm separation between the device and the user's body.”
iPhone 11 Pro Max	“During testing, iPhone radios are set to their highest transmission levels and placed in positions that simulate uses against the head, with no separation, and when worn or carried against the torso of the body, with 5mm separation.”
Nokia 8110 4G Phone (2019 Manual)	“This device meets RF exposure guidelines when used against the head or when positioned at least 5/8 inch (1.5 centimetres) away from the body. When a carry case, belt clip or other form of device holder is used for body-worn operation, it should not contain metal and should provide at least the above stated separation distance from the body.”
Safety & regulatory information (Pixel & Pixel XL 2016)	“Body worn operation: Pixel complies with radio frequency specifications when used near your ear or at a distance of 0.4 in (1.0 cm) from your body. Pixel XL complies with radio frequency specifications when used near your ear or at a distance of 0.4 in (1.0 cm) from your body. Ensure that the device accessories, such as a device case and device holster, are not composed of metal components. Keep the device away from your body to meet the distance requirement.”
Samsung 3G Laptop Manual	“Usage precautions during 3G connection: Keep safe distance from pregnant women’s stomach or from lower stomach of teenagers. Body worn operation: Important safety information regarding radiofrequency radiation (RF) exposure. To ensure compliance with RF exposure guidelines the Notebook PC must be used with a minimum of 20.8 cm antenna separation from the body.”

Owlcam Manual with RF Instructions	<p>“Caution exposure to radiofrequency radiation, to comply with FCC RF exposure compliance requirements for mobile configurations, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.”</p>
PlayStation 3	<p>“This equipment complies with FCC/IC radiation exposure limits set forth for uncontrolled equipment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65 and RSS-102 of the IC radio frequency (RF) Exposure rules. This equipment should be installed and operated with at least 20 cm (8 in) and more between the radiator and person’s body (excluding extremities: hands, wrists, feet and legs).”</p>
Amazon Echo	<p>“Information Regarding Exposure to Radio Frequency Energy...This device should be installed and operated with a minimum distance of 20cm between the radiator and your body. The remote control meets the RF exposure requirement of low power devices under portable operation. Nevertheless, it is advised to use the Products in such a manner that minimizes the potential for human contact during normal operation.”</p>
Panasonic DECT Home Cordless Phone	<p>“FCC RF Exposure Warning: To comply with FCC RF exposure requirements, the base unit must be installed and operated 20 cm (8 inches) or more between the product and all person’s body.”</p>
HP Printer	<p>“In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20 cm (8 inches) during normal operation.”</p>
Apple Watch	<p>“During testing, Apple Watch radios are set to their highest transmission levels and placed in positions that simulate use against the head, with 10mm separation, and on the wrist, with no separation. When placing Apple Watch near your face, keep at least 10mm of separation to ensure exposure levels remain at or below the as-tested levels.”</p>

Apple iPod Touch	<p>“During testing, iPod radios are set to their highest transmission levels and placed in positions that simulate use near the body, with 5mm separation.</p> <p>To reduce exposure to RF energy, use the supplied headphones or other similar accessories. Carry iPod at least 5mm away from your body to ensure exposure levels remain at or below the as-tested levels.”</p>
Nokia 8110 4G Phone (2019 Manual)	<p>“This device meets RF exposure guidelines when used against the head or when positioned at least 5/8 inch (1.5 centimetres) away from the body. When a carry case, belt clip or other form of device holder is used for body-worn operation, it should not contain metal and should provide at least the above stated separation distance from the body.”</p>

Apple Has Changed Their Text and No Longer Clearly Instructs Users to Keep the Phone at a Distance But Does Share the Test Distance

In 2015 the Apple iPhone 6 manual had the following [statement](#), “Carry iPhone at least 5mm away from your body to ensure exposure levels remain at or below the as-tested levels.” While this sentence was still on their website on [March 2, 2017](#), it was removed by [November 9, 2017](#). Similarly, the iPhone 7 was released in 2016, along with the same online instructions to carry it “5 mm away from your body” which disappeared from the Apple website by [November 9, 2017](#).

Apple’s [website](#) still includes information that cell phones are tested with a separation distance. However, the text is absent of clear instructions to consumers. Years ago, iPhone 3 [filings](#) to the FCC stated “iPhone’s SAR measurement may exceed the FCC exposure guidelines for body-worn operation if positioned less than 15 mm (5/8 inch) from the body (e.g. when carrying iPhone in your pocket).” Apple clearly stated, “When using iPhone near your body for voice calls or for wireless data transmission over a cellular network, keep iPhone at least 15 mm (5/8 inch) away from the body.”

Investigations Find Cell Phones Violate Cell Phone Regulatory Limits When the Phone is Tested at Body Contact

Chicago Tribune Cell Phone Radiation Tests

Tests paid for by the Tribune and conducted according to federal guidelines at an accredited lab, produced a surprising result: Radiofrequency radiation exposure from the iPhone 7 — one of the most popular smartphones ever sold — measured over the legal safety limit and more than double what Apple reported to federal regulators from its own testing. These tests measured radio frequency radiation SAR levels at 2mm from the body. [Chicago Tribune Cell Phone Test Report](#)

During Commission proceedings the CTIA countered that the FCC tested the phones the Chicago Tribune had reported to exceed SAR levels and released a report that found them to not to violate SAR limits. However, if you go to the FCC report on SAR measurements it shows that the FCC used a separation distance (on page 9)⁶⁶. The Chicago Tribune report specifically investigated phones at a distance of 2mm from the body. The FCC Report did not replicate the Chicago Tribune tests at 2mm but instead used the manufacturers separation distances which vary from 5 mm to 15mm.

Canadian Broadcasting Corporation

A 2017 [investigation](#) by the Canadian Broadcasting Corporation found radiation levels higher than government standards after they tested popular cell phones in a US FCC certified laboratory.

French ANFR

Professor Om Gandhi, one of the engineers who developed radiofrequency limits years ago, published an [analysis](#) of the [data](#) from 450 cell phone models from the French government agency, ANFR, the national radiation assessment bureau, indicating that phones can emit 11 times over the US FCC limit and 3 times over European/ICNIRP limits.

3. Why have 1,000s of peer-reviewed studies, including the recently published U.S. Toxicology Program 16-year \$30 million study, that are showing a wide range of statistically significant DNA damage, brain and heart tumors,

⁶⁶ FCC. [Results of Tests on Cell Phone RF Exposure Compliance](#).; 2019. Accessed July 8, 2020.

infertility, and so many other ailments, been ignored by the Federal Communication Commission (FCC)?

There has not been a scientific review of the research by a US agency for more than two decades.

Just recently in December 2019, the FCC determined that there was no need to review the radiofrequency limits. The FCC based this decision largely on a letter by the FDA. In the spring of 2020, the FDA released a research review, but it was not a systematic full evaluation of health effects, but instead only focused on cancer and criticized studies that found effects. FDA has not done experimental research on impacts to humans, birds, bees, trees, and wildlife. The FDA review does not systematically evaluate RF levels and impacts to birds, bees, and trees.

Most importantly, as the FCC states, there are no federally developed safety limits⁶⁷ and there is no US health agency developing such safety limits in the US.

There is not a single health/safety/environmental agency investigating, researching or monitoring impacts to birds, bees, trees, and wildlife. In addition, regulatory limits for exposure to radiofrequency radiation have never been developed for birds, bees, trees, and wildlife. This is why the [US Department of the Interior sent a letter](#) to the National Telecommunications and Information Administration in 2014⁶⁸ reviewing several research studies showing harm to birds and concluding that “the electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today.”

A now retired US Fish and Wildlife Service wildlife biologist and former lead on telecommunications impacts, Dr. Albert Manville, has written to the FCC on impacts to birds and higher frequencies to be used in 5G and authored numerous publications detailing research showing harm to birds.^{69, 70, 71} “Now as a private

⁶⁷ [Wireless Devices and Health Concerns](#) | Federal Communications Commission. Accessed July 8, 2020.

⁶⁸ Washington DC, Veenendaal ME. [Department of Interior Letter](#). *United States Department of the Interior OFFICE OF THE SECRETARY*.

⁶⁹ ECFS Filing Detail. <https://www.fcc.gov/ecfs/filing/1060315601199>. Accessed July 8, 2020.

⁷⁰ Albert M. Manville Ph.D. Former U.S. Fish and Wildlife Service Senior Biologist. [“Memorandum on the Bird and Wildlife Impacts of Non-ionizing Radiation.”](#) *Environmental Health Trust*. Accessed July 8, 2020.

⁷¹ Manville AM. “Collisions, Electrocutions, and Next Step : [Bird Strikes And Electrocutions At Power Lines](#),

wildlife consultant and part-time adjunct professor for Johns Hopkins University, I also continue to study the impacts of radiation on human health, welfare and safety, including impacts from millimeter-wide radiation frequencies on humans from 5G. The race to implement 5G and the push by FCC to approve the related 5G license frequencies to industry are very troubling and downright dangerous.”

He has testified⁷² about the impacts of cell towers on birds that “the entire thermal model and all FCC categorical exclusions for all the devices we see today, rests on the incorrect assumption that low-level nonionizing nonthermal radiation cannot cause DNA breaks because it is so low power. The evidence to the contrary is clear and growing laboratory animals and wildlife.”

Most recently Manville wrote the FDA regarding the FDA statements of “safety” in regards to cell phone radiation that, “as a certified wildlife biologist and Ph.D. environmental scientist who has studied the impacts of radiation on migratory birds, other wildlife, and humans since the late 1990s, the statement credited to the FDA is preposterous, without any scientific credibility, and at a minimum deserves a retraction by the FDA. There currently are well over 500 scientific, peer-reviewed papers addressing impacts of non-ionizing, non-thermal radiation on laboratory animals — many of the studies directly applicable to human health and safety.”⁷³

In addition, no “safe” level has been scientifically determined for long term impacts for children or pregnant women. While they are “designed” to address children, the reality is that no such research existed at the time of the limit development that actually considered children’s unique vulnerability which includes their developing brain and immune system. The EPA clarified that current FCC limits do not account for long term exposures⁷⁴ in 2002 stating, “Federal health and safety agencies have not yet developed policies concerning possible risk from long term, nonthermal exposures.” Current FCC human exposure limits “are thermally based, and do not apply to chronic, nonthermal exposure situations” and adequate scientific evaluations of the full impact on sensitive

[Communication Towers, And Wind Turbines: State Of The Art And State Of The Science - Next Steps Toward Mitigation.](#)”; 2002.

⁷² Manville AM. IPCWB. [Declaration of: Albert M. Manville, II, PhD, C.W.B.](#). Published 2018. Accessed July 8, 2020.

⁷³ [Statement From Dr. Albert Manville On The FDA Report On Cell Phone Radiation.](#) *Environmental Health Trust.* Accessed July 8, 2020.

⁷⁴ Washington DC. [United States Environmental Protection Agency.](#) 2002 <http://www.epagov>. Accessed July 8, 2020.

populations such as children, pregnant women, and the elderly has yet to be completed.

Background on US FCC Radiofrequency Human Exposure Limits

The FCC is not a health and safety agency and in fact never developed health based federal safety standards as we have with other environmental exposures.

Although there used to be a robust research effort in the United States in the '60s, '70s, and '80s, it was defunded. In fact, the US EPA was tasked to develop proper safety standards and was in process of developing two tiered guidelines on both thermal and biological effects in the mid-nineties. However, funding was cut and in 1996 the EPA was fully defunded from work on electromagnetic radiation. Then the FCC promulgated limits for human exposure to radiofrequency radiation based on the American National Standards Institute (ANSI), the Institute of Electrical and Electronics Engineers, Inc. (IEEE) – ANSI/IEEE C95.1-1992 guidelines and the National Council on Radiation Protection and Measurements (NCRP) NCRP Report 1986. The limits have remained largely unchanged since 1996.

In 2008 the National Academy of Sciences National Research Council Report "[The Identification of Research Needs Relating to Potential Biological or Adverse Health Effects of Wireless Communications Devices](#)" documented critical research gaps and called for the need to increase understanding of any adverse effects of long term chronic exposure to RF/microwave energy on children and pregnant women.

In 2008 the Congressional hearing "[Health Effects of Cell Phone Use](#)" of the US House Oversight and Government Reform Subcommittee on Domestic Policy had testimony from several experts including David Carpenter, Ronald B. Herberman M.D., Robert Hoover, Darrell Issa, and Julius P. Knapp II.⁷⁵

In 2009 a Senate Appropriations Subcommittee held a hearing on the "[Health Effects of Cell Phone Use](#)" and had testimony from several experts including John Bucher, Devra L. Davis, Thomas "Tom" Harkin, Dariusz Leszczynski, Olga Naidenko, and Siegal Sadetzki.⁷⁶

⁷⁵ 2008 Congressional Hearing: [Health Effects of Cell Phone Use](#)

⁷⁶ 2009 Hearing [link to transcript](#)

A 2012 report by the Government Accountability Office “[Exposure and Testing Requirements for Mobile Phones Should Be Reassessed](#)” urged the FCC to “formally reassess and, if appropriate, change its current RF energy (microwave) exposure limit and mobile phone testing requirements related to likely usage configurations, particularly when phones are held against the body” because without such a reassessment, the “FCC cannot ensure it is using a limit that reflects the latest research on RF energy exposure.” The report stated that the FCC RF limits adopted in 1996 did not reflect the way people use their phones, particularly when phones are held against and touching the body. The report led the FCC to launch an official inquiry⁷⁷ in 2013 to explore whether it should modify its radiofrequency exposure standards. The FCC noted, “we specifically seek comment as to whether our current limits are appropriate as they relate to device use by children.” The FCC docket asked these important questions: Are US cell phone and cell tower radiation limits safe for humans? Do children need special protections? Should companies change the way they test the radiation from phones because phones are tested with a separation distance between the phone and the body? The FCC received over a thousand submissions.⁷⁸

In 2019, the FCC issued a report and order⁷⁹ that closed the inquiry. It stated, “First, we resolve a Notice of Inquiry that sought public input on, among other issues, whether the Commission should amend its existing RF emission exposure limits. After reviewing the extensive record submitted in response to that inquiry, we find no appropriate basis for and thus decline to propose amendments to our existing limits at this time. We take to heart the findings of the Food & Drug Administration (FDA), an expert agency regarding the health impacts of consumer products, that “the weight of scientific evidence has not linked cell phones with any health problems.”

Scientists are calling for the FDA to retract their report that is now used as proof of safety. Due to the fact that the FDA later in 2020 released a report criticizing studies that found harm and provided no research demonstrating safety, several expert scientists wrote to the FDA.

⁷⁷ [Review of RF Exposure Policies | Federal Communications Commission](#)

⁷⁸ [ECFS filings results](#). Accessed July 8, 2020.

⁷⁹ FCC. [FCC 19-126. https://www.fda.gov/Radiation](#). Accessed July 8, 2020.

“I find it shocking that the FDA would casually dismiss the carcinogenicity findings from the National Toxicology Program (NTP) studies on cell phone radiation in experimental animals, when it was the FDA that requested those studies in the first place ‘to provide the basis to assess the risk to human health,’ and when an expert peer-review panel carefully reviewed the design and conduct of those studies and then concluded that the results provided “clear evidence of carcinogenic activity,” stated [Ronald Melnick PhD](#) who led the design of the \$30M NTP study. Melnick sent [a letter to the FDA](#) documenting the scientific inaccuracies in their review.

“When I worked as a wildlife biologist for the U.S. Fish & Wildlife Service for 17 years, I collaborated with the late Dr. Ted Litovitz in 2000. Dr. Litovitz and his colleagues studied the impacts of low-level, non-thermal radiation from the standard 915 MHz cell phone frequency on chicken embryos. In their laboratory studies, control/non-treated embryos suffered no effects, but some of the treated/irradiated embryos died — at levels as low as 1/10,000 the normal level of cell phone radiation exposure to humans. This was an eye-opener!” stated Albert M. Manville, II, Ph.D.; retired Senior Wildlife Biologist, Division of Migratory Bird Management, U.S. Fish & Wildlife Service, Washington.

“The FDA review omits an evaluation of the science on wireless radiation impacts to trees and wildlife. Electromagnetic radiation is a form of environmental pollution which may hurt wildlife. I have co-published research entitled [“Radiofrequency radiation injures trees around mobile phone base stations”](#) finding harm to trees near base stations (cell antennas) in a long term field monitoring study in two cities, “ stated biologist Alfonso Balmori, BSc who sent a [statement to the FDA](#).

Letters which have been sent to the FDA include:

- [Letter calling for a retraction signed by several scientists.](#)
- [Ronald Melnick PhD’s letter to the FDA on the National Toxicology Program study](#)
- [Albert Manville PhD, retired Senior Wildlife Biologist, Division of Migratory Bird Management, U.S. Fish & Wildlife Service, Wash. DC HQ Office \(17 years\); Senior Lecturer, Johns Hopkins University](#)

- [Prof. Tom Butler of the University College in Cork, Ireland’s letter to the FDA](#)
- [Igor Belyaev, PhD, Dr. Sc. Head, Department of Radiobiology of the Cancer Research Institute, Biomedical Research Center of the Slovak Academy of Science letter to the FDA](#)
- [Paul Heroux PhD, McGill University](#)
- [Alfonso Balmori, BSc statement to the FDA](#)
- [Additional Statements by Experts](#)

The FCC is considered a Captured Agency with Undue Influence by Telecom

Several experts who provided testimony to the Commission detailing how several FCC Commissioners have industry ties. Several cited the Harvard Press Book [“Captured Agency: How the Federal Communications Commission is Dominated by the Industries it Presumably Regulates”](#) by Norm Alster which documents the financial ties between the FCC, Congress and industry and how wireless companies have bought “inordinate access to—and power over—a major US regulatory agency.” The investigation puts forward that there is a “revolving door” between industry and regulators, meaning that persons are moving from positions in the wireless industry to positions in government and vice versa. In addition, the book documents the large financial investment by telecommunications companies into public relations efforts, designing and publishing contradictory science, pushing for minimal regulation, lobbying via “non-profit” associations, and “hyper aggressive legal action and research bullying.”

Examples of the revolving door at the Federal Communications Commission include:

- Tom Wheeler: In 2013, President Obama appointed Tom Wheeler to head the FCC. Wheeler, a fundraiser for Obama in the 2008 election, was a [lobbyist and head of the Cellular Telecommunications and Internet Association](#) (CTIA). As head of the wireless industry, [Wheeler was accused of suppressing science](#). A 2003 inductee into the Wireless Hall of Fame (yes, there is such a thing), Wheeler [laid the groundwork for 5G](#), pushing through regulations to strip local authority.

- Ajit Pai: In 2017, President Trump appointed Ajit Pai, a [former Verizon Lawyer](#) to [head the FCC](#). Pai had already been a member of the commission, having been appointed by President Obama in 2011 — upon the recommendation of Senate Majority Leader Mitch McConnell — to fill a “Republican” seat on the five-member board.
- Brendan Carr: FCC Commissioner Brendan Carr was [appointed by President Trump](#). He too is a former lawyer for Wiley Rein and helped [sue the San Francisco over the city’s cell phone ordinance](#). Carr’s wife is the staff director for the U.S. House Ways and Means Committee’s Oversight Subcommittee.
- Former FCC chairman Julius Genachowski is now [a managing director](#) of the U.S. buyout team at Carlyle Group. The team’s focus is on acquisitions and growth investments in global technology, media, and telecom, including Internet and mobile.
- Meredith Attwell Baker: [Former FCC Commissioner](#) Meredith Attwell Baker is now head of the CTIA - The Wireless Association. She is a former lead lobbyist for Comcast.
- Michael Powell: Former FCC commissioner Michael Powell is [now president & CEO of NCTA](#) - The Internet & Television Association.
- Bruce Romano: Former legal chief in the FCC’s Office of Engineering and Technology. Bruce Romano is [now at the law firm of Wiley Rein, representing the CTIA](#).
- Thomas M. Johnson, Jr.: Thomas M. Johnson, Jr. is general counsel of the FCC appointed by Ajit Pai and previously worked for the law firm Gibson, Dunn & Crutcher LLP which [represented the CTIA - The Wireless Association](#) who sued the City of Berkeley in federal court, seeking to topple the city’s recently enacted cell phone right to know ordinance mandating disclosure of possible radiation hazards associated with use of cellphones.

In addition, published research has documented conflicts of interest in the experts that governments refer to.

- The International Journal of Oncology published “World Health Organization, radiofrequency radiation and health – a hard nut to crack

(Review)”⁸⁰ in 2017 detailing conflicts of interest with ICNIRP and the WHO EMF Project, both started with industry support.

- The American Journal of Industrial Medicine published “Secret ties to industry and conflicting interests in cancer research”⁸¹ in 2006 about industry funding of studies such as the Danish Cohort cell phone studies that are often put forward as showing no harm.
- Molecular and Clinical Oncology published “Appeals that matter or not on a moratorium on the deployment of the fifth generation, 5G, for microwave radiation”⁸² in 2020 details how ICNIRP is referred to as “a private German non-governmental organization. ICNIRP [that] relies on the evaluation only of thermal (heating) effects from RF radiation, thereby excluding a large body of published science demonstrating the detrimental effects caused by non-thermal radiation.”

4. Why are the FCC-sanctioned guidelines for public exposure to wireless radiation based only on the thermal effect on the temperature of the skin and do not account for the non-thermal, non-ionizing, biological effects of wireless radiation?

In 1996, just as the EPA was [set](#) to release their [Phase 1](#) of safety limits, the EPA’s RFR efforts were defunded, halting all EPA research. That year the FCC [adopted RFR exposure limits](#) based largely on limits developed by industry/military connected groups ([ANSI/IEEE C95.1-1992](#) and [NCRP’s 1986 Report](#)).

These FCC limits are only based on protecting against heating (thermal) effects from short-term exposures. They do not account for non-thermal biological effects or the effects of long-term, chronic exposures. Furthermore, adequate scientific data on children's unique vulnerability to RFR was not available at that time. The US still has no federally developed safety limits, and there has been no systematic review of the scientific research to develop safety limits that adequately protect the public from long-term exposures.

⁸⁰ Hardell L. “[World health organization, radiofrequency radiation and health - A hard nut to crack \(Review\)](#).” *Int J Oncol*. 2017;51(2):405-413. doi:10.3892/ijo.2017.4046

⁸¹ Hardell L, Walker MJ, Walhjalt B, Friedman LS, Richter ED. “[Secret Ties to Industry and Conflicting Interests in Cancer Research](#).” *Am J Ind Med*. 2006. doi:10.1002/ajim.20357

⁸² Hardell L, Nyberg R. “[Appeals that matter or not on a moratorium on the deployment of the fifth generation, 5G, for microwave radiation](#).” *Mol Clin Oncol*. 2020;12(3):247-257. doi:10.3892/mco.2020.1984

Due to the lack of evaluation for long term safety and research that linked neurological impacts in firefighters to cell antenna exposure, the International Association of Fire Fighters has long opposed⁸³ cell antennas on fire stations stating that, “fire department facilities, where fire fighters and emergency response personnel live and work are not the proper place for a technology which could endanger their health and safety. The only reasonable and responsible course is to conduct a study of the highest scientific merit and integrity on the RF/MW radiation health effects to our membership and, in the interim, oppose the use of fire stations as base stations for towers and/or antennas for the conduction of cell phone transmissions until it is proven that such sitings are not hazardous to the health of our members.” The International Association of Fire Fighters passed a resolution⁸⁴ that they oppose cell towers on fire stations in 2004 and it remains in effect today.

5. Why are the FCC radiofrequency exposure limits set for the United States 100 times higher than countries like Russia, China, Italy, Switzerland, and most of Eastern Europe?

The following countries have cell tower network radiofrequency radiation limits (maximum permissible limits) below ICNIRP and FCC limits: Belarus, Bulgaria, China, Lithuania, Poland, Russia, Belgium, Chile, Greece, India, Israel, Italy, Liechtenstein and Switzerland.^{85 86 87 88 89}

The exposure guidelines developed by the FCC and International Commission on Non-Ionizing Radiation Protection (ICNIRP) were principally designed to protect against adverse thermal effects and were largely based on studies of short-term exposures to animals at high power levels. However, countries such as India,

⁸³ Cell Tower Radiation Health Effects - IAFF. <https://www.iaff.org/cell-tower-radiation/>. Accessed July 8, 2020.

⁸⁴ <https://ecfsapi.fcc.gov/file/109281319517547/20-Attachment%2020-%20Firefighters%20Inter%20Resolution%20Against%20Cell%20Towers.pdf>

⁸⁵ <https://apps.who.int/gho/data/node.main.EMFLIMITSPUBLICRADIOFREQUENCY?lang=en>

⁸⁶ Wu T, Rappaport TS, Collins CM. “[Safe for Generations to Come](#).” *IEEE Microw Mag*. 2015;16(2):65-84. doi:10.1109/MMM.2014.2377587

⁸⁷ Chiang, Huai. “[Rationale for Setting EMF Exposure Standards](#).” Zhejiang University School of Medicine, Microwave Lab, China, as referenced by Wu 2015

⁸⁸ “[Comparison of international policies on electromagnetic fields \(power frequency and radiofrequency fields\)](#).”

Rianne Stam, National Institute for Public Health and the Environment

⁸⁹ Mary Redmayne (2016). “[International policy and advisory response regarding children’s exposure to radio frequency electromagnetic fields \(RF-EMF\)](#).” *Electromagnetic Biology and Medicine*, 35:2, 176-185, DOI: [10.3109/15368378.2015.1038832](https://doi.org/10.3109/15368378.2015.1038832)

China and Russia have much lower limits and are considered “science based.”⁹⁰ They are well below any thermally significant levels to address their own countries research indicating adverse non-thermal health effects.

- USSR and Russian standards were based on many areas of research including impacts to the nervous system and immune system as documented in the “[Scientific basis for the Soviet and Russian radiofrequency standards for the general public.](#)” Their exposure limits are set based on protecting against possible biological consequences which is different than limits by the FCC and ICNIRP, which bases their limits on the lowest RF exposure that causes any “established” adverse health effect. Russia limits consider children to be more sensitive to EMFs and in need of “special consideration when developing exposure limits.” According to the ICNIRP, the following health hazards are likely to be faced in the near future by children who use mobile phones: disruption of memory, decline in attention, diminished learning and cognitive abilities, increased irritability, sleep problems, increase in sensitivity to stress, and increased epileptic readiness. For these reasons, special recommendations on child safety from mobile phones have been incorporated into the current Russian mobile phone standard.⁹¹
- China’s cell tower limits are based on science showing effects which include behavioral, neurological, reproductive abnormalities, and DNA damage.⁹²
- India dropped their RF limits by 1/10th of ICNIRP after a 2010 Government Report documented the majority of research studies found adverse effects to wildlife, birds and bees.⁹³ An August 2012 Advisory by the Ministry of the Environment and Forests refers to the “negative effects” and makes a series of recommendations to the government.⁹⁴ The findings of the report were later published in the journal *Biology and Medicine* which concludes that, “based on current available literature, it is justified to conclude that RF-EMF radiation exposure can change neurotransmitter functions, blood-brain barrier, morphology, electrophysiology, cellular metabolism, calcium

⁹⁰ Wu T, Rappaport TS, Collins CM. “[Safe for Generations to Come.](#)” *IEEE Microw Mag.* 2015;16(2):65-84. doi:10.1109/MMM.2014.2377587

⁹¹ “[Scientific basis for the Soviet and Russian radiofrequency standards for the general public.](#)”

⁹² Prof. Dr. Huai Chiang. “[Rationale for Setting EMF Exposure Standards.](#)” Accessed July 8, 2020.

⁹³ “[Report on Possible Impacts of Communication Towers on Wildlife Including Birds and Bees.](#)” Ministry of Environment and Forest, Government of India, 2010.

⁹⁴ Government of India Ministry of Environment and Forests Office. “[Advisory on the use of Mobile Towers to minimize their impact on Wildlife including Birds and Bees.](#)” 2012

efflux, and gene and protein expression in certain types of cells even at lower intensities”.⁹⁵

Many European countries have RF limits much lower than ICNIRP as part of their precautionary approach to decision-making. In 2011 the Parliamentary Assembly of the Council of Europe issued Resolution 1815: “The Potential Dangers of Electromagnetic Fields and Their Effect on the Environment”,⁹⁶ a call to European governments to “take all reasonable measures” to reduce exposure to electromagnetic fields “particularly the exposure to children and young people who seem to be most at risk from head tumors.” The Resolution calls for member states to:

- Implement “information campaigns about the risk of biological effects on the environment and human health, especially targeting children and young people of reproductive age.”
- “For children in general, and particularly in schools and classrooms, give preference to wired Internet connections, and strictly regulate the use of mobile phones by schoolchildren on school premises.”

Resolution 1815 specifically states that governments “Reconsider the scientific basis for the present standards on exposure to electromagnetic fields set by the International Commission on Non-Ionizing Radiation Protection, which have serious limitations, and apply ALARA principles, covering both thermal effects and the athermic or biological effects of electromagnetic emissions or radiation.”

6. Why did the World Health Organization (WHO) signify that wireless radiation is a Group B Possibly Carcinogenic to Humans category, a group that includes lead, thalidomide, and others, and why are some experts who sat on the WHO committee in 2011 now calling for it to be placed in the Group 1, which are known carcinogens, and why is such information being ignored by the FCC?

In 2011 wireless radiofrequency radiation was classified as a “Possible Human Carcinogen” by the International Agency for Research on Cancer (IARC) of the WHO based on research that found an increased risk for glioma, a malignant type

⁹⁵ Sivani S, Sudarsanam D. “[Impacts of Radio-Frequency Electromagnetic Field \(RF-EMF\) from Cell Phone Towers and Wireless Devices on Biosystem and Ecosystem - a Review.](#)” *Biology and Medicine* Vol 4.; 2012. www.biolmedonline.com. Accessed July 8, 2020.

⁹⁶ [Resolution 1815: “The Potential Dangers of Electromagnetic Fields and Their Effect on the Environment.”](#)

of brain cancer, associated with wireless phone use.⁹⁷ The WHO/IARC Class 2B classification includes wireless radiation from any transmitting source including cellphones, baby monitors, tablets, cell towers, radar, other Wi-Fi, etc. The classification applies to RF-EMF in the range of 30 KHz to 300 GHz emitted from any equipment- not just cell phones. This fact is detailed in the [Lancet's published statement](#) and in the related press release in 2011.

Precautions for cell phones were recommended by then IARC Director Christopher Wild in the WHO/IARC [press release](#) for the Class 2B Carcinogen classification with quotes from Wild as stating, "Given the potential consequences for public health of this classification and findings, it is important that additional research be conducted into the long-term, heavy use of mobile phones. Pending the availability of such information, it is important to take pragmatic measures to reduce exposure such as hands-free devices or texting."

After the 2011 classification, the WHO/IARC issued a monograph documenting all the research underpinning the 2011 classification.⁹⁸

The 2013 published monograph also references children's higher exposures as compared to adults and states, "the average exposure from use of the same mobile phone is higher by a factor of 2 in a child's brain and higher by a factor of 10 in the bone marrow of the skull."

The reason that scientists are calling for a change to the classification is that since the 2011 classification, the evidence for adverse effects in the published research has increased. Cancer is only one of the issues that have been investigated. Here are some of the studies often mentioned by scientists:

- The National Toxicology Program studies on cell phone radiation in animals found clear evidence of carcinogenic activity, in male rats and [DNA damage](#) in the frontal cortex of the brain in male mice, the blood cells of female mice, and the hippocampus of male rats.
- The multicenter case-control study [Coureau et al. 2014](#) found statistically significant positive association between brain tumors and cell phone use in the heaviest cell phone users when considering life-long cumulative duration.

⁹⁷ [IARC classifies Radiofrequency Electromagnetic Fields as possibly carcinogenic to humans](#)

⁹⁸ [Monograph on Non-Ionizing Radiation, Part 2: Radiofrequency Electromagnetic Fields.](#)

- An animal study [Lerchl 2015](#) replicated a previous study that found at very low levels, radiofrequency can promote tumors.
- [Falcioni et al. 2018](#) found a statistically significant increase in the incidence of heart Schwannomas in male rats exposed to radiofrequency radiation at levels below FCC limits.
- Yale research funded by the American Cancer Society⁹⁹ found thyroid cancer associated with cell phone use in people with genetic susceptibility.
- Additional Yale research¹⁰⁰ found prenatal radiofrequency radiation exposure led to higher hyperactivity, poorer memory, and altered brain function in mice,¹⁰¹ corroborating prior published [research](#) findings of altered brain development after exposure.
- A 2018 study¹⁰² looking at hundreds of adolescents found memory damage in the brain receiving some of the higher radiofrequency cell phone radiation exposures.
- A 2015 review study¹⁰³ found among 93 of 100 currently available peer-reviewed studies dealing with oxidative effects of low-intensity RFR, confirmation that RFR induces oxidative effects in biological systems.

The evaluation by some scientists that wireless is carcinogenic due to this increased body of published research can be found in [Hardell and Carlberg 2017](#) and [Miller et al. 2018](#).

Several scientists who were members of the WHO IARC 2011 monograph classification have publicly stated that the evidence on the carcinogenicity of RF has increased and that the classification of “possible carcinogen” is outdated and should be upgraded based on increased evidence of adverse effects.

⁹⁹ Jiajun Luo et al. “[Genetic susceptibility may modify the association between cell phone use and thyroid cancer: A population-based case-control study in Connecticut.](#)” *Environmental Research* (2019).

¹⁰⁰ Aldad, T., Gan, G., Gao, X., & Taylor, H. (2012). “[Fetal Radiofrequency Radiation Exposure From 800-1900 Mhz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice.](#)” *Scientific Reports*, 2(1).

<https://doi.org/10.1038/srep00312>

¹⁰¹ [Cell phone use in pregnancy may cause behavioral disorders in offspring](#)

¹⁰² Foerster, M., Thielens, A., Joseph, W., Eeftens, M., & Rössli, M. (2018). “[A Prospective Cohort Study of Adolescents’ Memory Performance and Individual Brain Dose of Microwave Radiation from Wireless Communication.](#)” *Environmental Health Perspectives*, 126(7), 077007. <https://doi.org/10.1289/ehp2427>

¹⁰³ Yakymenko, I., Tsybulin, O., Sidorik, E., Henshel, D., Kyrylenko, O., & Kyrylenko, S. (2015). “[Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation.](#)” *Electromagnetic Biology and Medicine*, 35(2), 186-202.

- Dr. Lennart Hardell in [Case-control study of the association between malignant brain tumours diagnosed between 2007 and 2009 and mobile and cordless phone use](#): “This study confirmed previous results of an association between mobile and cordless phone use and malignant brain tumours. These findings provide support for the hypothesis that RF-EMFs play a role both in the initiation and promotion stages of carcinogenesis.”
- Dr. Chris Portier: “A careful review of the scientific literature demonstrates there are potentially dangerous effects from RF,” stated Portier, a recently retired CDC Director, Center for Environmental Health and the Agency for Toxic Substances and Disease Registry [in his official call for invoking the precautionary principle with wireless](#) radiation in a 2015 conference. See also a poster presentation he penned for the conference [here](#).
- Dr. Igor Belyaev: “There are many publications showing health effects of radiofrequency radiations. Approximately half of all published papers show such effects.” ([National Press Club](#), 2012. [He has published findings of adverse effects in several publications.](#))
- [Dariusz Leszczynski](#), WHO IARC expert, former Finnish government researcher [stated in 2015](#) “The IARC-WHO classification of cell phone radiation is misrepresented by the industry. Classification of cell phone radiation as ‘a possible carcinogen to humans’ means that there are enough studies indicating that it might cause cancer and that we urgently need more research to clarify this issue. The strongest evidence that it might be causing cancer comes from three epidemiological studies. In 2011, only two sets of studies were available – EU’s Interphone study and a series of studies from Lennart Hardell’s group in Sweden. Recently, CERENAT study from France published in 2014, similarly indicated that persons using cell phones for more than ten years and for half hour per day are at a higher risk for developing brain cancer. In fact now the evidence is sufficient to consider cell phone radiation as a probable carcinogen – Group 2A in IARC’s scale of carcinogenicity.”
- Ronald Melnick, retired NTP staff scientist has written extensively on this topic and [states in Health Physics 2020](#), “The NTP studies show that the assumption that RF radiation is incapable of causing cancer or other adverse health effects other than by tissue heating is wrong.”

- [Anthony B. Miller, who served as an editorial reviewer of the IARC monograph, has also written](#) that if an IARC panel were to review the science at this point they would conclude that it should be reclassified as category 1, a human carcinogen.

In 2019, an advisory group of the International Agency for Research on Cancer (IARC) of the World Health Organization, consisting of 29 scientists from 18 countries, released new [recommendations](#) to reassess as a “high priority” the cancer risks of radiofrequency radiation between 2020–2024. The recommendations were published in The Lancet Oncology on April 18, 2019.

7. Why have more than 220 of the world’s leading scientists signed an appeal to the WHO and the United Nations to protect public health from wireless radiation and nothing has been done?

Over [393 scientists](#) and doctors from 35 countries have signed on to a declaration called the 5G Appeal,¹⁰⁴ sent to officials of the European Commission, calling for a moratorium on the increase of cell antennas for planned 5G expansion because “5G will substantially increase exposure to radiofrequency electromagnetic fields (RF-EMF) on top of the 2G, 3G, 4G, Wi-Fi, etc. for telecommunications already in place. RF-EMF has been proven to be harmful for humans and the environment.”

In addition, the 5G Appeal references the 2015 Scientific Appeal to the United Nations published in the European Journal of Oncology¹⁰⁵ now signed by 253 scientists who have published research on electromagnetic radiation which states that, “numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines. Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being in humans. Damage goes well beyond the human race, as there is growing evidence of harmful effects to both plant and animal life.”

¹⁰⁴ The 5G appeal – [5G Appeal 5G Appeal](#). Accessed July 8, 2020.

¹⁰⁵ EMFscientist.org - [International EMF Scientist Appeal](#). Accessed July 8, 2020.

Why has nothing been done?

The Scientific Appeal states that “the various agencies setting safety standards have failed to impose sufficient guidelines to protect the general public, particularly children who are more vulnerable to the effects of EMF.” The International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines do not cover long-term exposure and low-intensity effects, yet they are used by many governments as safety limits. The EMF scientists contend that the ICNIRP guidelines are insufficient to protect public health.

Dr. Lennart Hardell published a paper entitled, “[Appeals that matter or not on a moratorium on the deployment of the fifth generation, 5G, for microwave radiation](#)” explaining how ICNIRP is a private German non-governmental organization of 13 people that “relies on the evaluation only of thermal (heating) effects from RF radiation, thereby excluding a large body of published science demonstrating the detrimental effects caused by non-thermal radiation.” He contends that ICNIRP has disregarded research and that their safety guidelines are obsolete and protect the industry, not health. Hardell describes the communications between decision makers and the scientists and concludes that “the majority of decision makers are scientifically uninformed on health risks from RF radiation.” In addition, they seem to be uninterested in being informed by scientists representing the majority of the scientific community, i.e., those scientists who are concerned about the increasing evidence or even proof of harmful health effects below the ICNIRP guidelines (www.emfscientist.org). Instead, they rely on evaluations with inborn errors of conflicts, such as ICNIRP.

8. Why have the cumulative biological damaging effects of ever-growing numbers of pulse signals riding on the back of the electromagnetic sine waves not been explored, especially as the world embraces the Internet of Things, meaning all devices being connected by electromagnetic waves, and the exploration of the number of such pulse signals that will be created by implementation of 5G technology?

There are extensive data gaps regarding human exposure to wireless devices and the complexity of the waves we are exposed to. Most studies have not adequately explored all of these characteristics but instead only focus on power density.

“Adverse Health Effects of 5G Mobile Networking Technology Under Real Life Conditions”¹⁰⁶ published in Toxicology Letters states “the typical incoming EMF signal for many/most laboratory tests performed in the past consisted of single carrier wave frequency; the lower frequency superimposed signal containing the information was not always included. This omission may be important. As Panagopoulos states: “It is important to note that except for the RF/microwave carrier frequency, Extremely Low Frequencies - ELFs (0–3000 Hz) are always present in all telecommunication EMFs in the form of pulsing and modulation. There is significant evidence indicating that the effects of telecommunication EMFs on living organisms are mainly due to the included ELFs... While ~50 % of the studies employing simulated exposures do not find any effects, studies employing real-life exposures from commercially available devices display an almost 100% consistency in showing adverse effects” (Panagopoulos, 2019). These effects may be exacerbated further with 5 G: “with every new generation of telecommunication devices.....the amount of information transmitted each moment.....is increased, resulting in higher variability and complexity of the signals with the living cells/ organisms even more unable to adapt” (Panagopoulos, 2019).”

This is an area that requires adequate research before deployment.

¹⁰⁶ Kostoff RN, Heroux P, Aschner M, Tsatsakis A. “[Adverse health effects of 5G mobile networking technology under real-life conditions.](#)” *Toxicol Lett.* 2020;323:35-40. doi:10.1016/j.toxlet.2020.01.020

Appendix D

Sampling of Scientific Studies Pertaining to Cellphone Radiation

CANCER

2018 U.S. National Toxicology Program (NTP) & Italian Study Confirm Cell Phones Cause Cancer

- See the NTP website which indicates radiofrequency radiation is associated with "Clear evidence of tumors" -- the highest warning they can issue:
https://ntp.niehs.nih.gov/whatwestudy/topics/cellphones/index.html?utm_source=direct&utm_medium=prod&utm_campaign=ntpgolinks&utm_term=cellphone
- In the following article, study designer and former NTP Senior Scientist Ronald L. Melnick, PhD., counters with facts the industry spin intended to downplay the NTP study findings:
<https://www.sciencedirect.com/science/article/pii/S0013935118304973?via=ihub>
- In January 2020 the National Institutes of Environmental Health (NIEHS) published the following article from NTP scientist Michael Wyde, Ph.D., confirming brain, heart and adrenal tumors and that more research is underway to understand the impact of adding 5G millimeter waves to the existing exposures from 2G, 3G and 4G radiation:
<https://factor.niehs.nih.gov/2020/1/community-impact/5g-technology/index.htm>
- See study findings by the Ramazzini Institute study in Italy, which corroborates the NTP study findings:
<https://www.sciencedirect.com/science/article/pii/S0013935118300367?via=ihub>
- Longtime World Health Organization advisor [Anthony B. Miller, M.D.](#), and other experts, confirm radiofrequency (RF) radiation from any source now fully meets the World Health Organization criteria to be classified as a "Group 1 carcinogenic to humans" agent:
<https://www.sciencedirect.com/science/article/pii/S0013935118303475?via=ihub>

- BioMed Research International published a peer-reviewed study by Michael Carlberg, MSc, and Lennart Hardell, M.D., Ph.D. concluding "RF radiation should be regarded as a human carcinogen causing glioma."
<https://www.hindawi.com/journals/bmri/2017/9218486/>
- In 2018 IEEE Microwave Magazine published, "Clear Evidence of Cell Phone RF Radiation Cancer Risk" by Dr. James Lin:
<https://ieeexplore.ieee.org/document/8425056/?part=1>

Dr. Lin's article is also available in full here:

http://www.avaate.org/IMG/pdf/lin_2018.pdf

INFERTILITY

- Dr. Martin Pall's 2018 paper, "5G: Great risk for EU, U.S. and International Health! Compelling Evidence for Eight Distinct Types of Great Harm Caused by Electromagnetic Field (EMF) Exposures and the Mechanism that Causes Them" indicates much of the damage from wireless radiation is cumulative and some becomes irreversible.

His paper includes 16 scientific reviews (each referencing multiple individual peer-reviewed published studies) which include a wide variety of changes leading to lowered male fertility, lowered female fertility, increased spontaneous abortion, lowered levels of estrogen, progesterone and testosterone, and lowered libido.

The European Academy of Environmental Medicine provides Dr. Pall's paper here:

https://europaem.eu/attachments/article/131/2018-04_EU-EMF2018-5US.pdf

- See the 2018 paper, "Radiations and male fertility":
<https://rbej.biomedcentral.com/articles/10.1186/s12958-018-0431-1>
- See also abstracts for eight review papers and links to 40+ studies as collected by Dr. Joel Moskowitz:
<https://www.saferemr.com/2015/09/effect-of-mobile-phones-on-sperm.html>

- These studies address male fertility issues and wi-fi:
<http://www.ncbi.nlm.nih.gov/pubmed/22112647>
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3778601/>
<https://www.ncbi.nlm.nih.gov/pubmed/28967061>
- A 2017 study, "Temporal trends in sperm count: a systematic review and meta-regression analysis" shows sperm counts dropping dramatically:
<https://academic.oup.com/humupd/article/doi/10.1093/humupd/dmx022/4035689/Temporal-trends-in-sperm-count-a-systematic-review>
- Kaiser Permanente scientists completed a study that concluded non-ionizing radiation more than doubles the risk of miscarriage:
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5727515/>
- The EPA provides an understanding of how DNA mutations from radiation affect what we pass on to our offspring genetically:
http://www.epa.gov/radiation/understand/health_effects.html
- The following link provides an audio track from a 2013 conference led by leading U.S. experts in, "Cell Phones & WiFi – Are Children, Fetuses and Fertility at Risk?"
<http://electromagnetichealth.org/electromagnetic-health-blog/summary-and-audio/>
- Barrie Trower, PhD, "WiFi Report – Humanity At The Brink," September 2013, shows how wi-fi exposure now will affect fertility in the future:
<http://www.geoengineeringwatch.org/barrie-trower-wifi-report-humanity-at-the-brink/>
- A quick search of the National Institutes for Health (NIH) PubMed database on "emf fertility" returns a multitude of other studies from around the world:
<http://www.ncbi.nlm.nih.gov/m/pubmed/?term=emf+fertility>

ELECTROMAGNETIC SENSITIVITY

While adverse effects of long-term exposure to wi-fi radiation, like cancer, infertility and DNA damage may not surface in some for years, there are many who suffer immediate effects when exposed to wireless radiation. Health care providers are now learning to diagnose and treat environmentally induced electromagnetic sensitivity, or ES, also known as microwave sickness. Training for doctors, nurses, first responders and others will be provided in the continuing medical education (CME) accredited EMF Medical Conference 2021, <https://emfconference2021.com/>.

Those who suffer from ES can feel the radiation hitting various biological systems when they encounter cell towers, small cell antennas, routers, access points, cordless phones, smart meters, laptops, iPads, tablets, baby monitors, fluorescent lights or any other devices pulsing signal. Patients experience a myriad of immediate or latent symptoms that may include pain, tightening in the chest or skull, altered heartbeat, tinnitus or ringing in the ears, headaches, nosebleeds, insomnia, fatigue, diminished concentration, cognitive impairment, poor memory, behavioral issues, anxiety, depression, anger, suicidal ideation and more. Symptoms can disappear or diminish over time when exposure to electromagnetic fields (EMFs) is eliminated.

Following is a sampling of the science and actions being taken by the medical community, followed by recognition of ES by the Americans with Disabilities Act:

- Dominique Belpomme and Philippe Irigaray: "[Electrohypersensitivity as a Newly Identified and Characterized Neurologic Pathological Disorder: How to Diagnose, Treat, and Prevent It](#)," *Int J Mol Sci*. 2020 Mar; 21(6): 1915.
- "[Electromagnetic Field Sensitivity](#)," *Journal of Bioelectricity*: Vol 10, No 1-2.
- [Replication of heart rate variability provocation study](#)
- McCarty DE *et al*, (December 2011) "Electromagnetic hypersensitivity: evidence for a novel neurological syndrome," *Int J Neurosci*. 2011 Dec;121(12):670-6. Epub 2011 Sep 5 [[View Author's abstract conclusions](#)] [[View on Pubmed](#)]
- Nishimura T *et al*, (March 2011) "A 1-uT extremely low-frequency electromagnetic field vs. sham control for mild-to-moderate hypertension:

a double-blind, randomized study," *Hypertens Res.* 2011 Mar;34(3):372-7. Epub 2011 Jan 20 [[View Author's abstract conclusions](#)] [[View on Pubmed](#)]

- See other EHS papers at [Physicians](#) for Safe Technology: <https://mdsafetech.org/science/es-science/>
- The United States Access Board's IEQ Indoor Environmental Quality Project indicates electromagnetic sensitivities may be considered disabilities under the ADA: <https://www.access-board.gov/research/completed-research/indoor-environmental-quality/introduction>
- The Access Board recommends the following accommodations: <https://www.access-board.gov/research/completed-research/indoor-environmental-quality/recommendations-for-accommodations>
- Job Accommodation Network (JAN) is one of several services provided by the U.S. Department of Labor's [Office of Disability Employment Policy \(ODEP\)](#). JAN offers the following Accommodation Ideas for Electromagnetic Sensitivity: <http://askjan.org/soar/other/electrical.html>

VULNERABILITY OF CHILDREN

- Bioelectromagnetics expert Dr. Om Ghandi published in IEEE Access, "Yes the Children Are More Exposed to Radiofrequency Energy From Mobile Telephones Than Adults": <http://ieeexplore.ieee.org/document/7131429/?reload=true&arnumber=7131429&contentType=Journals%20%26%20Magazines>
- Pall, M. L. (2016). "Microwave frequency electromagnetic fields (EMFs) produce widespread neuropsychiatric effects including depression." *Journal of Chemical Neuroanatomy*, 75(Pt B), 43–51. <https://doi.org/10.1016/j.jchemneu.2015.08.001>
- Warnke, U., & Hensinger, P. (2013). "Increasing incidence of burnout due to magnetic and electromagnetic fields of cell phone networks and other wireless communication technologies." (Original: Steigende „Burn-out“-Inzidenz durch technisch erzeugte magnesche und elektromagnesche Felder des Mobil- und Kommunikaonsfunks, Umwelt·medizin·gesellschaft, 26(1), 31-38. http://avaate.org/IMG/pdf/warnke_hensinger_umg_1_2013_engl_df.pdf

- Martha Herbert, PhD, MD, a leading neuroscientist and autism expert, “Findings in Autism (ASD) Consistent with Electromagnetic Fields (EMF) and Radiofrequency Radiation (RFR)”:
https://bioinitiative.org/wp-content/uploads/pdfs/sec20_2012_Findings_in_Autism.pdf
- Dr. Toril Jelter, pediatrician and general practitioner, discusses EMF, Autism and Child Behavior in an 8-minute video. She prescribes a two-week trial with limited wi-fi exposure and patients often have remarkable results in just a few days:
<https://www.youtube.com/watch?v=O3iRrVQPDBk>
- Hugh Taylor, MD, Yale University discusses ADHD symptoms seen in mice exposed to cell phone radiation:
<http://vimeo.com/73806192>
- Studies have found adverse effects on offspring from prenatal exposure to wireless radiation:
<http://www.saferemr.com/2014/06/joint-statement-on-pregnancy-and.html>
- Dr. Toril Jelter, pediatrician and general practitioner, discusses EMF, Autism and Child Behavior in an 8-minute video. She prescribes a two-week trial with limited wi-fi exposure and patients often have remarkable results in just a few days:
<https://www.youtube.com/watch?v=O3iRrVQPDBk>
- Barrie Trower, a former physicist with the British Royal Navy and expert in radiation, explains in the following two-part lecture the dangers of using wi-fi radiation. He is particularly concerned for the welfare of children and fetuses:
<http://www.youtube.com/watch?v=5xgJmeQaQmc>
<http://www.youtube.com/watch?v=UhcuSEHVOSM>
- The [American Academy of Environmental Medicine](#) has issued an *Open Letter to the Superintendents* imploring them to protect our children.
- The American Academy of Pediatrics (AAP), representing 60,000 pediatricians, in December 2012 urged Congress to protect children from the dangers of wi-fi. "It is essential that any new standards for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded through their

lifetimes." The full letter is published here:

<http://www.electrosmogprevention.org/cell-phone-safety-campaign/american-academy-of-pediatrics-supports-rf-protection/>

In addition to the biological effects of radiation on children, science is showing excessive screen time is causing addiction, impairing our children's ability to function and is degrading family and social relationships. Here is a sampling of books that bring forth the science and safe technology solutions:

- Dr. Nicholas Kardaras, addiction expert, has clinically worked with more than a thousand teens. He published the book *Glow Kids* which shows how screen addiction is hijacking our kids and offers strategies to break the trance.
- Dr. Catherine Steiner-Adair offers [*The Big Disconnect*](#), which takes one through technology's impact at each stage of child development. Basically, the left side of the brain where math and science are housed is still developing on point. The right side, however, is not in many children. This is where a child's ability to show empathy, employ coping strategies, make eye contact, and self-soothe are housed. In humans, we need regular human contact and deep meaningful interactions with loved ones and teachers to develop these properly. Children also need unstructured time for imaginative play to develop deep parts of our brains. Although well-intended parents think providing their children with technology will give them a leg up, the research is proving otherwise as we begin to see scores dropping after upping technology time, and behavioral and mental health issues are escalating.
- In [*Reset Your Child's Brain*](#), Dr. Victoria Dunkley explains the myriad ways in which children can be harmed by electronic screen syndrome (ESS). Biologically, electronic screen exposure can cause a chronic fight or flight response, and hit the same opiate receptors in the brain as drugs and alcohol causing addiction. Children with attention issues and those with autism are at higher risk of addiction. If not given appropriate time to rest and regenerate, children begin to suffer chronically. Common symptoms are irritability, depression and mood swings. As ESS progresses, mood dysregulation may combine with aggression causing some to be diagnosed with bi-polar disease. Others may develop obsessive-compulsive behavior, nightmares, panic attacks, tics, seizures, etc., as the effects take hold on the brain. Dr. Dunkley demonstrates how freedom from electronic screens can

change the brain and alleviate or significantly reduce many of these symptoms. She offers a four-week plan to reverse the effects of ESS. See also her article in [Psychology Today](#).

- Paula Healy steps us through the psychological and neurological impact of screentime in this 37 minute talk, *How our Digital Obsession is Dumbing us Down*:
https://www.youtube.com/watch?v=OM_IFijB9rA&feature=youtu.be
- Dr. Marilyn Wedge explains how screens are impairing development in “Virtual Autism” *May Explain Explosive Rise in ASD Diagnoses*:
https://www.madinamerica.com/2017/08/virtual-autism-explain-rising-asd-diagnoses/?fbclid=IwAR0K7A5j36mbGDKdNdafUBPG0TNdHcC9hj4Id_tKJZx6GSf_pcZExVIgJZs

Additionally, Silicon Valley executives limit their own children’s access to technology while promoting it to others’ children:

- Apple's Steve Jobs and other technology executives limited their own children's technology exposure:
<http://www.nytimes.com/2014/09/11/fashion/steve-jobs-apple-was-a-low-tech-parent.html?smid=fb-share&r=1>
- The Digital Gap Between Rich and Poor Kids Is Not What We Expected: America’s public schools are still promoting devices with screens — even offering digital-only preschools. The rich are banning screens from class altogether.
<https://www.nytimes.com/2018/10/26/style/digital-divide-screens-schools.html?action=click&module=RelatedLinks&pgtype=Article>
- A Dark Consensus About Screens and Kids Begins to Emerge in Silicon Valley: “I am convinced the devil lives in our phones.”
https://www.nytimes.com/2018/10/26/style/phones-children-silicon-valley.html?action=click&contentCollection=undefined&contentPlacement=4&module=stream_unit&pgtype=collection®ion=stream&rref=collection%2Fbyline%2Fnellie-bowles&version=latest
- Silicon Valley Nannies Are Phone Police for Kids: Child care contracts now demand that nannies hide phones, tablets, computers and TVs from their charges.
<https://www.nytimes.com/2018/10/26/style/silicon-valley-nannies.html>

Appendix E

Challenges to the Radiation Exposure Standards Set by U.S. Regulatory Agencies

Organizations Recommending Reducing Wireless Radiation Thresholds

[5G Appeal to the European Union by Hundreds of Scientists](#)

[American Academy of Pediatrics – Letters Calling for Updating Radiation Standards](#)

[US Doctors and Experts National 5G Resolution](#)

[EMF Scientist Appeal](#)

[International Society of Doctors for Environment – Appeal for a 5G Standstill](#)

[The EMF Call – Protective Limits for Exposure to Electromagnetic Fields](#)

[Vienna Medical Association](#)

[Scientists Join Canadian Doctor Appeal on 5G](#)

[Ontario Doctors Appeal and former Microsoft Canada President](#)

[The European Scientific Committee on Health, Environmental and Emerging Risks](#)

[Worcester School’s Standing Committee consulted with the Massachusetts Department of Epidemiology – Best Practices, Minimizing Exposure to RF](#)

[ANSES, France’s National Agency for Food, Environmental and Occupational Health Safety – Recommends Moderate Use of Wireless Communication Technologies by Children](#)

[ANSES, France’s National Agency for Food, Environmental and Occupational Health Safety – Recommends Limiting The Population’s Exposure to RF](#)

[World Health Organization’s International Agency for Research.](#)

[New Jersey Education Association – Minimize Health Risks from Electronic Devices](#)

[Environment and Human Health, Inc. – Technology, Exposures, Health Effects](#)

[Irish Doctors Environmental Association](#)

[Bioinitiative Working Group – 2012 Report on Biologically Based Exposure Standards](#)

[International Appeal to Stop 5G on Earth and in Space, Scientists \(4,503\), Engineers \(8,036\), Medical Doctors \(2,593\), Nurses \(4,177\), Psychologists, Psychotherapists and Social Workers\(9,663\)](#)

[German Environmental Organisation “Bund” – Petition to Stop 5G in Hamburg](#)

[German Doctors Delegation – Open Letter to Prime Minister Kretschmann](#)

[Hippocrates Electrosmog Appeal of Belgium – Over 550 Health Professional Signatures](#)

[Pancyprian Medical Association & Cyprus National Committee on the Environment and Child Health – Public Health Dangers from the 5G Network](#)

[California Department of Public Health – Reduce Exposure to Radiofrequency From Cell Phones](#)

[The BabySafe Project – Health Professionals Warn of Dangers of Wireless Radiation on Pregnancy](#)

[Turin Medical Association of Italy – Changes in the Law on Electromagnetic Radiation Needed](#)

[Department of Pediatrics at Hadassah Hebrew University Hospital – Statement by Dr. Eitan Kerem](#)

[The American Academy of Environmental Medicine – Recommendations, Letter to the FCC](#)

[Association for Consumer Protection in Romania](#)

[Cleveland Clinic](#)

[Swiss Physicians Association of Doctors for Environmental Protection – Apply The Precautionary Principle for Wireless Devices](#)

[Swiss Physicians Association of Doctors for Environmental Protection – Preliminary Draft for a Federal Law Protecting Against the Dangers of Non-Ionizing Radiation](#)

[African Cancer Organization – Advisory to Keep Children From Mobile Phones](#)

[The Cyprus National Committee on Environment and Child Health – Recommendations to Reduce Exposure to Children](#)

[Austrian Medical Association – Nicosia Declaration on Health Impacts from EMF and RF Radiation](#)

[Austrian Medical Association – Practical Rules to Decrease Wireless EMF Radiation Exposure](#)

[Santa Clara County Medical Association Magazine](#)

[Connecticut Department of Public Health – Cell Phone Safety Bulletin](#)

[Athens Medical Association – Measures to Protect Against Electromagnetic Radiation](#)

[Canadian Parliament Standing Committee on Health of the House of Commons](#)

[Pittsburgh Cancer Institute](#)

LETTERS TO FDA

- [Press releases from scientists challenging radiation limits](#)
- [Letter calling for a retraction signed by several scientists.](#)
- [Ronald Melnick PhD’s letter to the FDA on the National Toxicology Program study](#)
- [Albert Manville PhD, retired Senior Wildlife Biologist, Division of Migratory Bird Management, U.S. Fish & Wildlife Service, Wash. DC HQ Office \(17 years\); Senior Lecturer, Johns Hopkins University](#)
- [Prof. Tom Butler of the University College in Cork, Ireland’s letter to the FDA](#)

- [Igor Belyaev, PhD, Dr. Sc. Head, Department of Radiobiology of the Cancer Research Institute, Biomedical Research Center of the Slovak Academy of Science letter to the FDA](#)
- [Paul Heroux PhD, McGill University](#)
- [Alfonso Balmori, BSc statement to the FDA](#)

LETTERS AND OFFICIAL BRIEFINGS ON 5G

Briefing on 5G Health Impacts by Dr. Martin Pall: [“5G: Great Risk for EU, U.S. and International Health! Compelling Evidence for Eight Distinct Types of Great Harm Caused by Electromagnetic Field \(EMF\) Exposures and the Mechanism that Causes Them”](#)

November 19, 2018 – Magda Havas, BSc, PhD, Trent University, Peterborough, Canada – [Open Letter: Need to Consider Health Effects Associated with Radio Frequency and Microwave Radiation before Deployment of 5G](#)

November 19, 2018 – Paul Héroux, PhD, Professor of Toxicology and Health Effects of Electromagnetism, McGill University Medicine, Montreal – [Open Letter](#)

November 21, 2018 – Yuri Grigoriev, Dr. Sc. Med., Professor, Academician of Russian Academy of Electrotechnical Sciences – [Open Letter: From Electromagnetic Smog to Electromagnetic Chaos Evaluating the Hazards of Mobile Communication for Public Health](#)

December 7, 2018 – David O. Carpenter, MD, Director, Institute for Health and the Environment, University at Albany, State University of New York – [Open Letter to Ministers and Members of Parliament of the Brussels Capital Region](#)

December 13, 2018 – Olle Johansson, PhD, associate professor / retired from the Karolinska Institute, Stockholm, Sweden, and the Royal Institute of Technology, Stockholm, Sweden – [Letter of Concern, addressed to the decision-makers of the City of Brussels](#)

May 15, 2019- Magda Havas, BSc, PhD, Trent University, Peterborough, Canada [Affidavit on 5G to Canadian Parliament with non-profit EMF OFF.](#)

LETTERS FROM ORGANIZATIONS AND OTHERS

[Letter from Frank Clegg, former President of Microsoft, Canada](#)

[Letter from EMF 249 Scientists to Mr. Charles Parkinson/Mrs. Andrea Dudley-Owen President & Vice President of Economic Development, The States of Guernsey, Re: 5G](#)

[Letter from Jerry L. Phillips Ph.D. to Mr. Charles Parkinson & Mrs. A Dudley-Owen President & Vice President Of Economic Development, The States of Guernsey, Re: 5G](#)

[Letter from Paul Héroux, PhD to The States of Guernsey, Re: 5G](#)

[Health Effects of Electromagnetism \(Detailed Report\) submitted to The States of Guernsey by Paul Héroux, PhD](#)

[Letter from Anthony B. Miller, MD, FRCP to Gavin St Pier Esq, Chief Minister, The States of Guernsey, Re: 5G](#)

[Letter from Professor Colin Pritchard to The States of Guernsey, Re: 5G](#)

[Declaration to European Commission by 180 Scientists Calling for a Moratorium on 5G Cell Antennas, September 13, 2017](#)

[National Health Integrated Associates October 29, 2018 Letter to Montgomery County Council](#)

[Letter from Dr. Lennart Hardell To Governor Jerry Brown on SB649](#)

[Beatrice Alexandra Golomb, MD, PhD Lettter in Opposition to SB649](#)

[Letter from Dr. Martin Pall in Opposition to SB649](#)

[Attachment to Dr. Pall Letter – 142 Microwave Radiation Review Studies](#)

[Letter from Dr. Devra Davis to Chair Aguiar-Curry on SB 649, June 28, 2017](#)

[Letter from Dr. Devra Davis to Governor Jerry Brown on SB 649, September 17, 2017](#)

[Letter from Dr. Paul Ben Ishai in Opposition to SB 649, September 08, 2017](#)

[Letter from Dr. Cindy Russell in opposition to SB 649](#)

[Letter from Physicians For Safe Technology in opposition to SB 649](#)

[Article from Dr. Cindy Russell on Impacts of 5G Technology, January 2017](#)

[Santa Clara Bulletin, pg. 20-23, “A 5G Wireless Future: Will It Give Us a Smart Nation or Contribute to An Unhealthy One?” by Cindy Russell, January 2017](#)

[Letter from Dr. Joel Moskowitz To Governor Jerry Brown on SB 649](#)

[Beatrice Alexandra Golomb, MD, PhD Letter in Opposition to SB 649](#)

[Letter from Dr. Sam Milhelm](#)

[Letter from Dr. John West](#)

[Letter from Dr. Hugh Scully to the City of Toronto](#)

[Letter from Dr. Stephen Sinatra to Toronto City Councilors in Opposition to Item 26.21](#)

[Joint letter from 541 health, environment and justice advocates and organizations to US Senators and Representatives in opposition to bills on 5G and wireless radiation expansion – November 13, 2017](#)

[Ellie Marks Letter to Governor Brown SB 649](#)

[Letter from the Alliance of Nurses for Health Environments](#)

[Letter from Environmental Working Group June 26, 2017](#)

[Letter from Environmental Working Group July 26, 2017](#)

[8/20 National Institute for Science, Law & Public Policy Letter to Appropriations Committee](#)

[8/21 National Institute for Science, Law & Public Policy Letter to Assembly](#)

[8/24 National Institute for Science, Law & Public Policy Letter to Governor Brown.](#)

[Letter from the Sierra Club, August 15, 2017](#)

[Letter from Greenlining Institute, June 27, 2017](#)

[Letter from the American Association of Retired Persons \(AARP\), July 19, 2017](#)

[Letter from Law Office of Harry Lehmann “Mass casualties are likely in District 10 from passage of 648”, July 6, 2017](#)

[Letter from Law Office of Harry Lehmann to State of California, “Liability for Damage From Microwave Radiation Exposure Sustained by Senate Bill 649 Will Be Shifted to California State”, July 19, 2017](#)

[Letter from Law Office of Harry Lehmann, “SB 649 will disproportionately effect the poor in California”, August 24, 2017](#)

[Letter from EMF Safety Network and Ecological Options Network, July 06, 2017](#)

[Letter by Susan Foster Assembly Appropriations Letter – Fire Station Exemption from SB 649, August 14, 2017](#)

[Letter from Susan Foster and Radiation Research Trust in of Opposition of SB 649, June 22, 2017](#)

Scientists For Wired Technology, 5/30/17: [front](#) and [back](#)

Scientists For Wired Technology 5/31/17:[front](#) and [back](#)

[American Planning Association Opposes SB 649](#)

[Berkeley City Council Opposition Letter, April 25, 2017](#)

SCIENTIFIC COMMENTS TO THE FCC

[Comments by Ronald M. Powell, PhD, to the FCC on Spectrum Frontiers](#)

[Comments by The Berkshire-Litchfield Environmental Council to the FCC on Spectrum Frontiers, July 12, 2016](#)

[Comments by Dr. Albert Manville to the FCC on Spectrum Frontiers, July 14, 2016](#)

[Comments by Dr. Joel Moskowitz to the FCC on Spectrum Frontiers, July 20, 2016](#)

[Comments by Dr. Yael Stein to the FCC on Spectrum Frontiers, July 09, 2016](#)

[Comments by Dr. Devra Davis to the FCC on Spectrum Frontiers](#)

[Comments by Susan Clarke to the FCC on Spectrum Frontiers, July 14, 2016](#)

[Comments by EMF Scientist Appeal Advisors to the FCC on Spectrum Frontiers, June 09, 2017](#)

[Letters by Scientists and Doctors on Small Cells and 5G](#)

Appendix F

Wireless Exposure Limits in Different Countries

The exposure limits given below are from the [website of Physicians for Safe Technology](#)

Japan	600 microwatts/cm ²
U.S.A.	450 microwatts/cm ²
Canada	450 microwatts/cm ²
Australia	450 microwatts/cm ²
Austria	450 microwatts/cm ²
France	450 microwatts/cm ²
Germany	450 microwatts/cm ²
Hungary	450 microwatts/cm ²
Ireland	450 microwatts/cm ²
Luxembourg	450 microwatts/cm ²
Portugal	450 microwatts/cm ²
Spain	450 microwatts/cm ²
India	45 microwatts/cm ²
China	40 microwatts/cm ²
Russia	10 microwatts/cm ²
Italy	10 microwatts/cm ²
Bulgaria	10 microwatts/cm ²
Poland	10 microwatts/cm ²
Lichtenstein	10 microwatts/cm ²
Switzerland	10 microwatts/cm ²
Belgium	2.4 microwatts/cm ²
Ukraine	2.5 microwatts/cm ²
Cosmic	<0.00000000001 microwatts/cm ²



Appendix G

Captured Agencies and Conflicts of Interest

Alster, Norm, *Captured Agency: How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates*, Edmond J. Safra Center for Ethics, Harvard University. The report can be accessed [here](#).

Conflicts of Interest Among Those Who Set Radiation Limits

- In Europe, the public radiation limits are set by the International Committee on Non-Ionizing Radiation Protection (ICNIRP). Investigate Europe, a team of investigative journalists expose that ICNIRP members have extensive conflicts of interest with industry. Dr. Joel Moskowitz chronicles their findings, and additional studies that show ICNIRP scientists are working for industry:
<https://www.saferemr.com/2018/07/icnirps-exposure-guidelines-for-radio.html>
- The 98 page report, "*The International Commission on Non-Ionizing Radiation Protection: Conflicts of interest, corporate capture and the push for 5G*" was commissioned, coordinated and published in 2020 by two Members of the European Parliament – Michèle Rivasi and Klaus Buchner:
<https://www.saferemr.com/2018/07/icnirps-exposure-guidelines-for-radio.html>
- Priyanka Bandara, Ph.D., and others in 2020 published *5G Wireless Deployment and Health Risks: Time for a Medical Discussion in Australia and New Zealand* which cites conflicts of interest with industry and current evidence of harm:
https://www.researchgate.net/publication/343416307_5G_Wireless_Deployment_and_Health_Risks_Time_for_a_Medical_Discussion_in_Australia_and_New_Zealand

Conflicts of Interest at the World Health Organization

- In 2016 the authors of the BioInitiative Report, which summarizes thousands of peer-reviewed scientific studies showing wireless technology is harmful, submitted a No-Confidence letter to the WHO's EMF program manager because the committee no longer includes appropriate representation from non-industry funded EMF scientific experts:

<http://www.bioinitiative.org/bioinitiative-working-group-issues-a-no-confidence-letter-to-the-who-emf-program-manager/>.

- The [Russian National Committee on Non-Ionizing Radiation Protection](#) issued a similar letter in March 2017.
- Over 250 of the world's leading EMF scientists and biologists have signed a formal appeal to the World Health Organization with a clear plan to inform and protect the public from wireless radiation:
<https://www.emfscientist.org/>
- Columbia University's Dr. Martin Blank provides a three-minute introduction to the Appeal that summarizes the issue: <https://vimeo.com/123468632>
- The head of the WHO's "International EMF Project" has heavy ties to the telecom industry. Further, she does not have EMF scientific or medical credentials and is not listening to the scientists proving electromagnetic fields are hazardous. A former UN employee, Olga Sheean of Canada, submitted a petition to get qualified leadership in place:
<http://olgasheean.com/who-emf/>.
- In 2017, the International Journal of Oncology published a report by Dr. Lennart Hardell explaining the WHO has conflicts of interest with industry and does not plan to take action to protect the public from non-thermal electromagnetic radiation, even though the scientific and epidemiological evidence of harm is well documented:
<https://www.spandidos-publications.com/10.3892/ijo.2017.4046>
- In 2020, the WHO's "International EMF Project" reopened its investigation into Electromagnetic Fields:
https://www.who.int/peh-emf/research/rf_ehc_page/en/index1.html

The WHO's "International EMF Project" is composed of those with close ties to industry and is separate from the another WHO group that in 2011 determined EMFs to be Group 2B: Possibly Carcinogenic to Humans. The latter group is the "International Agency for Research on Cancer (IARC)" which has non-industry funded scientific experts in the biological effects of EMFs. It remains to be seen what will come of the investigation launched in 2020:

<https://ehtrust.org/scientists-call-for-transparency-at-the-world-health-organization-emf-project/>

Appendix H

Example of an RF radiation warning

Study:
913 pregnant women;
Greater exposure to magnetic
fields from wireless radiation
increased risk of miscarriage
by 48%.

#knowyourexposure
#babysafeproject



Learn how to reduce your exposure.
Visit: www.BabySafeProject.org

The graphic features a purple background on the left with white text, and a yellow background on the right with a pink icon of a pregnant woman and three curved lines representing radiation waves. The bottom of the graphic has a blue and white striped pattern.

Appendix I

Example of a symbol for use on poles and other structures located in public rights-of way that hold 5G antennae



Appendix J

Deleterious effects of impulsive radiation

While current FCC guidelines for non-ionizing radiation exposure are based upon heating effects, there is a growing body of research showing that the impulsive nature of high-speed data transmission can cause deleterious health effects at considerably lower radiation levels. Three references that document the effect of the impulsive radiation are given below:

[1] Belyaev, I., Dean, A., Eger, H. et al. "EUROPAEM EMF Guideline 2016 for the prevention, diagnosis, and treatment of EMF-related health problems and illnesses." *Rev environ Health*. 2016;31(3):363-397. Doi:10.1515/reveh-2016-0011.

[2] B. W. G. (2012). "Bioinitiative 2012: A Rationale for Biologically-based Exposure Standards for Low-Intensity Electromagnetic Radiation."

[3] McCarty, D. E., Carrubba, S., Chesson, A. L., Frilot, C., Gonzalez-Toledo, E., & Marino, A. A. (2011). "Electromagnetic hypersensitivity: P Evidence for a novel neurological syndrome." *International Journal of Neuroscience*, 121(12), 670-676.

Appendix K

Siting restrictions for wireless antennae

The siting restrictions for cell phone towers already in force in the world were intended to ensure the safety of vulnerable populations, like children and those with illnesses.

India already prohibits placement of cell phone towers near schools or hospitals, and Canada (Standing Committee on Health), as well as many European countries, are looking into similar restrictions.

CALIFORNIA FIREMEN

California firemen are exempted from the forced placement of towers on or adjacent to their stations, because of radiation health concerns.

“The International Association of Fire Fighters’ position on locating cell towers commercial wireless infrastructure on fire department facilities, as adopted by its membership in August 2004, is that the IAFF oppose the use of fire stations as base stations for towers and/or antennas for the conduction of cell phone transmissions until a study with the highest scientific merit and integrity on health effects of exposure to low-intensity RF/MW radiation is conducted and it is proven that such sitings are not hazardous to the health of our members.”

<https://ecfsapi.fcc.gov/file/109281319517547/20-Attachment%2020-%20Firefighters%20Inter%20Resolution%20Against%20Cell%20Towers.pdf>

<https://vimeo.com/122670207>

<https://web.archive.org/web/20150403040308/http://www.stopcellphonetowers.com/index.html%20>

https://www.youtube.com/watch?v=61h_vuBujw0

<http://cbsloc.al/2DNAYA5>

<https://sanfrancisco.cbslocal.com/2018/01/25/consumerwatch-5g-cellphone-towers-signal-renewed-concerns-over-impacts-on-health>

https://ehtrust.org/wp-content/uploads/HARDELL-14-October-2014_1-1.pdf

This was codified in [Government, section 65964.1. \(f\)](#) as enacted by California's legislation AB 57 in 2015:

"Due to the unique duties and infrastructure requirements for the swift and effective deployment of firefighters, this section does not apply to a collocation or siting application for a wireless telecommunications facility where the project is proposed for placement on fire department facilities."

A similar provision was included in California's SB 649 (2018), "Wireless Telecommunications Facilities" under item 65964.2.:

"(a) A small cell shall be a permitted use subject only to a permitting process adopted by a city or county pursuant to subdivision (b) if it satisfies the following requirements: ... (3) The small cell is not located on a fire department facility."

On October 15, 2018, Governor Jerry Brown vetoed SB 649, the so-called small-cell bill, which would have usurped local authority over the siting of telecom equipment.

To the Members of the California State Senate:
I am returning Senate Bill 649 without my signature.

This bill establishes a uniform permitting process for small cell wireless equipment and fixes the rates local governments may charge for placement of that equipment on city or county owned property, such as streetlights and traffic signal poles.

There is something of real value in having a process that results in extending this innovative technology rapidly and efficiently. Nevertheless, I believe that the interest which localities have in managing rights of way requires a more balanced solution than the one achieved in this bill.

Sincerely, Edmund G. Brown Jr.

ESTABLISHING SETBACK

To increase wireless data rates, the 5G industry seeks higher frequencies. These frequencies distribute energy in a smaller fraction of the body and need higher field intensities because of (1) poor penetration into structures, (2) absorption of radiation by oxygen and water, (3) shrinking antenna apertures, as well as (4) noise from an increasing number of extraneous sources.

For human users, this means increased power density exposures. In addition, exposures will become more irregular because of beam-forming, as well as originate from multiple sources (Multiple-Input Multiple-Output architecture).

Since there is no epidemiological or animal data, and very few laboratory results using 5G, cautionary setbacks should be established by the municipalities based upon past 3G and 4G systems.

The verdict on animal studies is expressed in reports by (1) the US National Toxicology Program, (2) the Ramazzini Institute, and by older studies by (3) Chou (1992) and (4) Repacholi (1997).

The verdict on epidemiology is expressed in two reports (ELF and RF) from the *International Agency for Research on Cancer* (“possibly carcinogenic”), which Agency is scheduled to review evidence on RF carcinogenicity between now and 2024.

Senator Blumenthal:

<https://www.radiationresearch.org/articles/us-senator-blumenthal-raises-concerns-on-5g-wireless-technology-health-risks-at-senate-hearing-youtube/>

US National Toxicology Program – Impact of Cell Phones:

<https://ntp.niehs.nih.gov/results/areas/cellphones/index.html>

Ramazzini Institute – Impact of Base Stations:

<https://www.ncbi.nlm.nih.gov/pubmed/29530389>

International Agency for Research on Cancer – ELF:

<https://monographs.iarc.fr/wp-content/uploads/2018/06/mono80.pdf>

https://www.iarc.fr/wp-content/uploads/2018/07/pr208_E.pdf

International Agency for Research on Cancer – RF:

<https://publications.iarc.fr/Book-And-Report-Series/IARC-Monographs-On-The-Identification-Of-Carcinogenic-Hazards-To-Humans/Non-ionizing-Radiation-Part-2-Radiofrequency-Electromagnetic-Fields-2013>

https://www.iarc.fr/wp-content/uploads/2018/07/pr208_E.pdf

Chou, 1992: <https://onlinelibrary.wiley.com/doi/abs/10.1002/bem.2250130605>

Repacholi, 1997: <https://www.ncbi.nlm.nih.gov/pubmed/9146709>

As vulnerable individuals are exposed involuntarily every day in society to RF-radiation, caution should be universally used and set according to the Largest Observed Adverse Effect Distance (LOAED), using the experience from past and current 2G, 3G, and 4G networks. A conservative LOAED should include all observed health effects.

Best engineering practice would therefore apply a set-back requirement for new cellular towers, including 5G micro-towers.

From the 17 documents referred to in this appendix, shown below in historical order, this set-back for all new cell towers should be 500 meters which translates to 1,640 feet.

All of these studies have been given support by a recent animal study from the Ramazzini Institute that links to them, as well as to the US National Toxicology Program result on cell phones.

REFERENCES

Paola **Michelozzi**, Alessandra Capon, Ursula Kirchmayer, Francesco Forastiere, Annibale Biggeri, Alessandra Barca, and Carlo A. Perucci.

“Adult and Childhood Leukemia near a High-Power Radio Station in Rome,” Italy. *American Journal of Epidemiology*, Vol. 155, No. 12, (2002) 1096-1103.

Michelozzi et al 2002 describe an increased risk for childhood leukemia at distances up to 6 km from the powerful Vatican Radio transmitters near Cesano, Italy, which led to compensation by decision of Italy’s Supreme Court (relative risk of 7 for lymphomas and myeloma, and 5 for non-Hodgkin’s lymphoma and leukemia).

<https://pubmed.ncbi.nlm.nih.gov/12048223/>

R. **Santini**, P. Santini, P. Le Ruz, J. M. Danze, and M. Seignel. "Survey Study of People Living in the Vicinity of Cellular Phone Basestations." *Electromagnetic Biology and Medicine*. Vol. 22, No. 1, pp. 41-49, 2003.

Santini et al 2003 surveyed by questionnaire 530 people living or not in proximity to cellular phone Base Stations (BSs) in France. Eighteen different symptoms (Non-Specific Health Symptoms-NSHS), described as radiofrequency sickness, were studied. Certain complaints are experienced only in the immediate vicinity of BSs (up to 10 m for nausea, loss of appetite, visual disturbances), and others at greater distances from BSs (up to 100 m for irritability, depressive tendencies, lowering of libido, and up to 200 m for headaches, sleep disturbances, feeling of discomfort). In the 200 m to 300 m zone, only the complaint of fatigue is experienced significantly more often when compared with subjects residing at more than 300 m or not exposed (reference group). For seven of the studied symptoms and for the distance up to 300 m, the frequency of reported complaints is significantly higher ($P < 0.05$) for women in comparison with men. <https://www.tandfonline.com/doi/abs/10.1081/jbc-120020353>

Michael **Kundi**, Hans-Peter Hutter. "Mobile phone base stations—Effects on wellbeing and health." *Pathophysiology* 16 (2009) 123–135.

Kundi and Hutter 2009 comment that studying effects of mobile phone base station signals on health have been discouraged by authoritative bodies like the WHO. As a result, only few investigations of effects of base station exposure on health and wellbeing exist. But two ecological studies of cancer in the vicinity of base stations report both a strong increase of incidence within a radius of 350 and 400 m, respectively. It is suggested that power densities around 500–1000 $\mu\text{W}/\text{m}^2$ must be exceeded in order to observe an effect.

<https://pubmed.ncbi.nlm.nih.gov/19261451/>

Vini G. **Khurana**, Lennart Hardell, Joris Everaert, Alicja Bortkiewicz, Michael Carlberg, Mikko Ahonen. "Epidemiological Evidence for a Health Risk from Mobile Phone Base Stations." *International Journal of Occupational and Environmental Health*. July 2010;16:263–267. DOI: 10.1179/107735210799160192.

Khurana et al 2010 provides a review of 10 BS proximity and neurobehavioral effects, and three investigations of cancer. Eight of the 10 studies reported increased prevalence of adverse neurobehavioral symptoms or cancer in populations living at distances < 500 meters from BSs.

<https://pubmed.ncbi.nlm.nih.gov/20662418/>

Adilza C. **Dode**, Mônica M.D. Leão, Francisco de A.F. Tejo, Antônio C.R. Gomes, Daiana C. Dode, Michael C. Dode, Cristina W. Moreira, Vânia A. Condessa, Cláudia Albinatti, Waleska T. Caiaffa. “Mortality by neoplasia and cellular telephone base stations in the Belo Horizonte municipality, Minas Gerais state, Brazil.” *Science of the Total Environment* 409 (2011) 3649–3665.

Dode et al 2011 provides the most detailed information. Belo Horizonte is the third largest city in Brazil. It was been selected by the Population Crisis Committee of the United Nations (UN, 2007) as the metropolis with the best quality of life in Latin America. Its health system is considered very good, according to the Atlas of Human Development (2000/United Nations Development Program).

In 2011, a 10-year study on cell phone antennas was released by the Municipal Health Department and several local universities. The study was conducted in a broad environmental context, aiming to verify if there is a spatial correlation between the cellular telephony system BS location and the cases of death by neoplasia during the period between 1996 and 2006. Three data banks were used: 1. death by neoplasia documented by the Municipal Health Department; 2. BS documented in ANATEL (Telecommunications National Agency); and 3. census and demographic city population data obtained from official archives provided by IBGE (Brazilian Institute of Geography and Statistics). The results show that approximately 856 BSs were installed through December 2006.

Between 1996 and 2006, 7191 deaths by neoplasia occurred and, within an area of 500 m from the BS, the mortality rate was 34.76 per 10,000 inhabitants. Outside of this area, a decrease in the number of deaths by neoplasia occurred. The greatest accumulated incidence was 5.83 per 1000 in the Central-Southern region and the lowest incidence was 2.05 per 1000 in the Barreiro region. During the environmental monitoring, the largest electric field measured was 12.4 V/m and the smallest was 0.4 V/m. The largest power density was 407,800 $\mu\text{W}/\text{m}^2$, and the smallest was 400 $\mu\text{W}/\text{m}^2$.

<https://pubmed.ncbi.nlm.nih.gov/21741680/>

Ermanno **Affuso**, J. Reid Cummings, Huubinh Le. “Wireless Towers and Home Values: An Alternative Valuation Approach Using a Spatial Econometric Analysis.” *Journal of Real Estate Finance and Economics* (2018) 56:653–676. DOI 10.1007/s11146-017-9600-9.

Affuso et al 2018 examines the economic impact on home values. For properties located within 0.72 kilometers of the closest tower, results reveal significant declines of 2.46% on average, and up to 9.78% for homes within tower visibility range compared to homes outside tower visibility range.

<https://link.springer.com/article/10.1007/s11146-017-9600-9>

Falcioni L., L. Bua, E. Tibaldi, M. Lauriola, L. De Angelis, F. Gnudi, D. Mandrioli, M. Manservigi, F. Manservigi, I. Manzoli, I. Menghetti, R. Montella, S. Panzacchi, D. Sgargi, V. Stollo, A. Vornoli, F. Belpoggi.

Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz GSM base station environmental emission.

Environmental Research 165 (2018) 496–503.

Falcioni et al 2018 conclude: the Ramazzini Institute findings on far field exposure to RFR are consistent with and reinforce the results of the NTP study on near field exposure, as both reported an increase in the incidence of tumors of the brain and heart in RFR-exposed Sprague-Dawley rats. These tumors are of the same histotype of those observed in some epidemiological studies on cell phone users. These experimental studies provide sufficient evidence to call for the reevaluation of IARC conclusions regarding the carcinogenic potential of RFR in humans.

<https://www.avaate.org/IMG/pdf/belpoggi-heart-and-brain-tumors-base-station-2018.pdf>

J.M. **Pearce.** “Limiting liability with positioning to minimize negative health effects of cellular phone towers.” *Environmental Research* 181 (2020) 108845.

Pearce et al 2020 provides the most recent assessment and promotes a 500 m set-back to limit future liabilities of the cell phone industry, based on correlation with headaches, dizziness, depression and other neurobehavioral symptoms, as well as increased cancer risk. It is almost inevitable that such economic impacts will increase in the future.

<https://www.sciencedirect.com/science/article/abs/pii/S0013935119306425>

Other References

Buchner K et al. (2011): [Modification of clinically important neurotransmitters under the influence of modulated high-frequency fields - A long-term study under true-to-life conditions]. In German. Abstract translation below.

This long-term study over one and a half years shows a significant activation of the 60 participants' adrenergic systems after the installation of a regional mobile telephone transmitting station in the village of Rimbach (Bavaria).

The values of the stress hormones adrenaline and noradrenaline grow significantly during the first six months after starting the GSM transmitter; the values of the precursor substance dopamine decreases substantially after the beginning of the radiation (Wilcoxon test, $p < 0,0002$). The initial condition is not restored even after one and a half years. Due to the not regulable chronic difficulties of the stress balance, the phenylethylamine (PEA) values drop until the end of the research period (Wilcoxon test, $p < 0,0001$). The effects show a dose effect relation and are situated far under the valid limits for technical high-frequency stress. Chronic dysregulations of the catecholamine system have substantial health relevance and cause health damages in the long run.

Wolf R, Wolf D. "Increased incidence of cancer near a cell-phone transmitter station." *Int J Canc Prev* 2004; 1 (2): 123-128. Publication unavailable online.

Conclusion according to the authors: Of the 622 people of area A, 8 cases of different kinds of cancer were diagnosed in a period of one year (from July 1997 - June 1998). The cancer incidence rate was 129 cases per 10,000 persons per year in area A compared to 16/10,000 in area B and 31/10,000 in the town of Netanya. Relative cancer rates for females were 10.5 for area A, 0.6 for area B and 1 for Netanya. The authors conclude that the study indicates an association between increased incidence of cancer and living in proximity to a mobile phone base station.

Eger H, Hagen KU, Lucas B, Vogel P, Voit H. [Influence of proximity to mobile telephony transmitters on cancer incidence]. *Umwelt-Medizin-Gesellschaft* 2004; 17 (4): 326-332. In German. Author's conclusion translated below.

320 of 967 residents of Naila have been living in the inner circle at a distance to the next base station of less than 400 m. The results showed an increased risk for malignant tumors for patients living closer than 400 m to the mobile telephony transmitter compared to patients living further away.

In the years 1999 - 2004 the risk for malignant tumors tripled for patients living in the proximity of the mobile telephony transmitter.

Appendix L

Measurement of RF intensities within frequency ranges throughout state

The majority of the Commission suggests this data include location, frequency ranges, peak, and average power intensities of total combined RF emitted by sources such as 3G, 4G, or 5G cellphone networks, Wi-Fi, smart meters, IOT devices, and similar devices. The data should be collected in such a way as to identify possible areas of notably high RF exposure, places where RF signal for wireless communication is inadequate (dead spots), and places where RF is unusually low (white zones) that are sought by people who wish to minimize their exposure.

RF data collected and mapped should be archived and published on a state website, accompanied by state-wide and regional aggregated averages for both peak and 24-hour integrated microwatts/meter squared intensities. The state should also publish benchmarks for comparison: a few readings from low-intensity underdeveloped areas, and nearby some strong high-intensity sources (base of a tower) for min-max comparison. The Bioinitiative 2012 recommends that human peak exposure not exceed an RF intensity of 1,000 microwatts/meter squared.

One use of this data will be buyers/renters of property or the public in general using these benchmark values to make comparisons and form their own decisions based on their comfort level. After a while, an extensive NH RF database will exist to provide useful maps and data for future public health investigations.

Appendix M

The enabling technology and scientific rationale for automatically stopping cell phones from operating when held against the body

The FCC testing procedure for certification of cell phones aims for a power injection into the head below 1.6 Watts per kilogram of tissue. The accuracy of SAR determinations is not very high (variation between laboratories), and some cellular phones have been found to exceed this limit

(<https://www.chicagotribune.com/investigations/ct-cell-phone-radiation-testing-20190821-72qgu4nzlfda5kyuhteieh4da-story.html>).

A major problem is that the FCC testing procedure allows the phone to be tested up to 0.98 inches (2.5cm) from the head, at which distance injection of energy into the head is much reduced compared to when held against the head as is done routinely by users. “Small print” instructions already present in many cell phone manuals instruct users to hold cell phones at a distance from the head, in full knowledge that this is not likely to be done.

In France, measurements by the National Frequency Agency (ANFR) revealed that 9 out of 10 mobile phones tested in 2015 under real use conditions (in contact with the body) exceeded the legal limit, leading to extensive recalls

(<https://www.phonegatealert.org/en/phonegate-scandal-where-are-we-three-years-after-the-alert-was-launched>).

We provide here a simple change expected to reduce the number of glioblastomas and other tumors in cell phone users by mandating that cell phones turn off their radiation when held right against the head or body.

IMPLEMENTATION

A reliable method to reduce head exposure to radiation is to configure the phone itself to automatically shut off, protecting the user’s brain. Cellular phones already contain a small device called a *proximity sensor* (shown at right is the miniature



Sharp GP2AP002S00F), usually located at the top of the phone. The element on the left of the sensor sends out pulsed infrared which is detected by the element on the right, if the phone is near an object. The image sequence at right shows how a finger turns off the screen.



In present Android devices, the proximity sensor triggers as the user's face is close to the screen, switching off the screen and preventing any errant soft-button presses by the skin as well as saving battery power.

Some Android devices can report the distance to another object in centimeters, whereas others will simply report minimum and maximum values to denote *near* and *far*, respectively. These functions are accessed through *SensorManager* and *Sensor* classes from the Android Application Programming Interface (API).

Similarly, the iPhone proximity sensor (also using infrared) is designed to detect any object near the screen and is used to put the display to sleep when the iPhone is against the head, preventing unintentional display triggering.

Assigning to the user the task of keeping the phone away from the head is not practical. The phone itself should disable its RF emissions if proximity is detected. This means that the user could use the phone away from the head, in his hand, or on a table in front of him. At the cost of a small change in personal habits, this measure would instantly remove high SAR exposures from cell phone usage and would remove the need for sophisticated assessment of exact SAR measurements in close body proximity. Note that this phone adjustment does not prevent alerting the user to incoming calls. But it does prevent the unit from autonomously sending out data when held against the body. A number of applications ("apps") have in recent years contributed to user exposures by radiating data even without user intervention. This automatic data traffic tends to increase and should only be permitted if the device is held away from the body. Essentially, this software adjustment is an automated "Airplane Mode", designed to protect users from radiation.

JUSTIFICATION

For cellular phones, commonly held against the head, prolonged use has led to an increase in a lethal form of brain cancer, glioblastoma, as well as with a more benign tumor, acoustic neuroma, in 9 peer-reviewed studies, including one cohort study.

- Brain Tumours: Rise in Glioblastoma Multiforme Incidence in England 1995–2015 Suggests an Adverse Environmental or Lifestyle Factor. Alasdair Philips, Denis L. Henshaw, Graham Lamburn, and Michael J.O’Carroll. Journal of Environmental and Public Health Volume 2018, Article ID 7910754, (<https://doi.org/10.1155/2018/7910754>),
- Use of mobile phones and cordless phones is associated with increased risk for glioma and acoustic neuroma. Lennart Hardell, Michael Carlberg, Kjell Hansson Mild. Pathophysiology 20 (2013) 85–110. <https://www.sciencedirect.com/science/article/abs/pii/S0928468012001101>

Recent studies have also linked cell phone use to cancer.

The US National Toxicology Program,

<https://ntp.niehs.nih.gov/results/areas/cellphones/index.html>,

the International Agency for Research on Cancer,

<https://publications.iarc.fr/Book-And-Report-Series/Iarc-Monographs-On-The-Identification-Of-Carcinogenic-Hazards-To-Humans/Non-ionizing-Radiation-Part-2-Radiofrequency-Electromagnetic-Fields-2013>,

as well as individual large studies by Chou,

<https://onlinelibrary.wiley.com/doi/abs/10.1002/bem.2250130605>,

Repacholi,

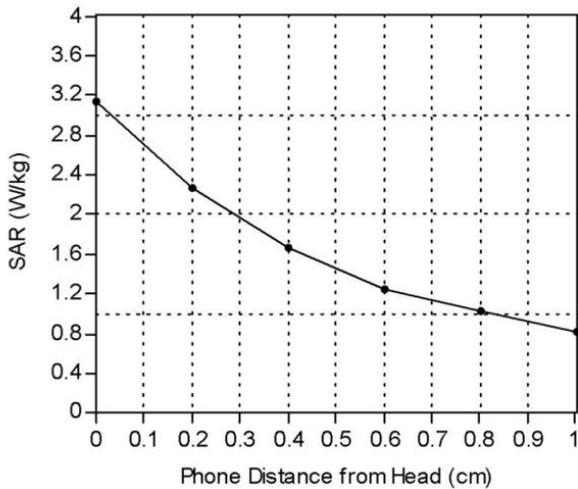
<https://www.ncbi.nlm.nih.gov/pubmed/9146709>,

as well as a collective opinion of scientists,

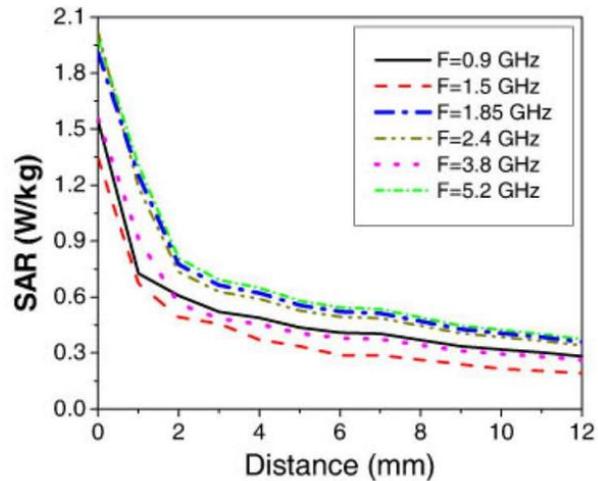
<https://bioinitiative.org/>.

Engineering analysis indicates that the dose delivered to the brain decreases rapidly as distance between cellular phone and head rises. As shown below, it

decreases by as much as 4 to 5 times, according to two separate analyses, as the phone is moved 1 cm (0.4") away.



A comparative study of the distance effects of human head from mobile phone radiation.
S. Iman Zanoori, S. Vahab Al-Din Makki, Abdorreza Torabi.
International Journal of Microwave and Optical Technology, Vol.10, No.1, January 2015.



Design of low sar planar monopole antenna for mobile wireless communication applications.
Dalia M. E Isheakh and Esmat A. Abdallah.
Progress in Electromagnetics Research M, Vol. 29, 137- 149, 2013.

While walkie-talkies of the past were used more distantly from the head, the recent trend has been to reduce the size of cellular phones and to promote a style of use identical to that of the telephone which is pressed against the ear. An unfortunate consequence has been to deliver large doses of EMR to tissues of the nervous system which have been shown to be adversely affected, as stated above.

Without altering the function of cellular phones, it is technically possible to seriously reduce exposure to the brain of users by altering how the phones are held when emitting radiation, specifically by holding them away from the body.

Appendix N

Research on the effects of wireless radiation on trees, plants, birds, insects, pollinators, and wildlife

FCC limits were not developed to protect our flora or fauna. Wireless radiation “safety” limits for trees, plants, birds, insects, pollinators, and wildlife simply do not exist. No US agency nor international authority with expertise in science, biology or safety has ever acted to review research and set safety limits on these non-human species.

The [Department of Interior wrote a letter in 2014](#) detailing several published studies showing impacts of wireless radiofrequency radiation (RFR) to birds. It stated the following:

There is a growing level of anecdotal evidence linking effects of non-thermal, non-ionizing electromagnetic radiation from communication towers on nesting and roosting wild birds and other wildlife in the U.S.

However, the electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today.

... third-party peer-reviewed studies need to be conducted in the U.S. to begin examining the effects from radiation on migratory birds and other trust species.

Study results have documented nest and site abandonment, plumage deterioration, locomotion problems, reduced survivorship, and death (e.g., Balmori 2005, Balmori and Hallberg 2007, and Everaert and Bauwens 2007). Nesting migratory birds and their offspring have apparently been affected by the radiation from cellular phone towers in the 900 and 1800 MHz frequency ranges- 915 MHz is the standard cellular phone frequency used in the United States.

In laboratory studies, T. Litovitz (personal communication) and DiCarlo et al. (2002) raised concerns about impacts of low-level, non-thermal electromagnetic radiation from the standard 915 MHz cell phone frequency on domestic chicken embryos- with some lethal results (Manville 2009, 2013a). Radiation at extremely low levels (0.0001 the level emitted by the average digital cellular telephone) caused heart attacks and the deaths of some chicken embryos subjected to hypoxic conditions in the laboratory while controls subjected to hypoxia were unaffected (DiCarlo et al. 2002).

Albert Manville, former senior biologist of the US Fish and Wildlife Service wrote [“A BRIEFING MEMORANDUM: What We Know, Can Infer, and Don’t Yet Know about Impacts from Thermal and Non-thermal Non-ionizing Radiation to Birds and Other Wildlife”](#) published in Wildlife and Habitat Conservation Solutions, 2014 on the impacts of RFR to birds and bees. India dropped their RF limits by 1/10th after a [research review](#) documented the majority of research studies found adverse effects to wildlife, birds and bees.

Regarding bees and pollinators, the study [“Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz”](#) published in Scientific Reports found insects (including the Western honeybee) can absorb the higher frequencies that will be used in the 4G/5G rollout, with absorbed power increases up to 370%. The researchers warn, “This could lead to changes in insect behaviour, physiology, and morphology over time...” Research also has found impacts to bees from wireless frequencies including inducing artificial worker piping ([Favre, 2011](#)), disrupting navigation abilities ([Sainudeen, 2011](#); [Kimmel et al., 2007](#)), reducing colony strength ([Harst et al., 2006](#)), and impacts to honey bee physiology ([Kumar et al., 2011](#)).

Research on trees has found that trees are harmed by RFR. A 9 year field study ([Waldmann-Selsam, C., et al 2016](#)) found significant impacts to trees near cell antennas and an investigation of 700 trees found [damage starts on the side of the tree with highest RF](#). A review on impacts to plants entitled, [“Weak radiofrequency radiation exposure from mobile phone radiation on plants”](#) concluded, “a substantial amount of the studies on RF-EMFs from mobile phones show physiological and/or morphological effects.” A study on aspen seedlings found ambient RF in a Colorado setting were high enough to cause necrotic lesions on the leaves, decrease leader length and leaf area, and suppress fall anthocyanin production ([Haggarty, 2010](#)).

[The European Scientific Committee on Health, Environmental and Emerging Risks](#) states, “The lack of clear evidence to inform the development of exposure guidelines to 5G technology leaves open the possibility of unintended biological consequences.” Several literature reviews warn that non-ionizing EMFs are an “emerging threat” to wildlife ([Balmori, 2015](#), [Curachi, 2013](#), [Sivani, 2012](#)).

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Appendix O

Meeting Minutes

**NH COMMISSION TO STUDY THE ENVIRONMENTAL AND HEALTH EFFECTS
OF EVOLVING 5G TECHNOLOGY**

Meeting held:

9/16/19

9:00-10:00 am

LOB 202

Meeting called to order by Rep Abrami at 9:00 am.

In attendance: (9) *(Each member discussed their backgrounds)*

Rep. Patrick Abrami-speaker of the house appointee

Senator Tom Sherman-president of the senate appointee

Rep. Ken Weeks- speaker of the house appointee

Kent Chamberlin-UNH-appointed by the chancellor

Carol Miller-NH Business & Economic Affairs Dept.

Denise Ricciardi-public-appointed by the governor

Michelle Roberge-DHHS- Commissioner of DHHS appointee

Rep. Gary Woods-speaker of the house appointee

Senator Jim Gray-president of the senate appointee

Excused: (1)

Dr. Paul Heroux- Professor of Toxicology, McGill University- speaker of the house appointee

To be filled: (6)

AG or designee

2 members of the NH High Tech Council

1 member of NH Medical Society, specializing in environmental medicine/electromagnetic radiation

1 member of cell phone/wireless industry

1 member of Business and Industry Association

Agenda: (attached)

- I. Member introductions and background
- II. Election of Chair:
 - Rep. Patrick Abrami was nominated by Senator Tom Sherman, seconded by Rep Gary Woods. Vote was unanimous.
- III. Guiding Principles: (see attached and attached HB522)
 - Senator Sherman: committee decorum protocol, ask permission of chair to speak or rebut.
- IV. Statement of Purpose and Goals: (see attached)
 - Rep. Abrami: Why do we need state level? Fed is not doing much. States are pushing back against the Federal government as small cells are rolled out in front of homes. Because we cannot see it or feel it, except those who are sensitive, doesn't mean it is

not an issue for health and the environment. A sixth goal was added to communicate conclusions to all federal agencies with jurisdiction and the Office of the President.

V. Questions Needing Answers: (see attached)

-Senator Gray: We need to look at all radiation, not just 5G. Is it good or bad? Is it frequency? Intensity? How much is too much? Think broadly, not just 5G.

-Senator Sherman: Applying Precautionary Principle is most important. We are not looking for proof positive, but risk. Lack of knowledge does not equal safety. Is there potential harm here? Public health policy is not black and white. The goal is to protect public health.

-Rep Woods: we need a good understanding of baseline ambient level and levels relative to that.

-Kent Chamberlin: Concerns of cybersecurity and military issues and from sources not under U.S. control, not just biological.

-Denise Ricciardi: Health epidemic avoidance, constitutional privacy issues, data collection. Our job is to get to the truth for public health.

-Rep Abrami: Let it take us where it leads us. Root discussion is RF radiation. We cannot talk about 5G without RF in general.

VI. List of organizations in which testimony will be requested. (see attached)

-Rep Abrami: There will be no problem bringing in people with tremendous science credentials. I am hoping to get someone in to refute that. We need back and forth discussion. The harder problem will be in getting people to testify rebutting findings. Joel is research resource for the commission.

Discussion:

- Rep Abrami: US National Toxicology findings, WHO, FCC. We need to understand FCC standards and why they only test for thermal effects, ignoring biological effects. We may need to skype people in as we do not have a budget for this.
- Senator Sherman: who is making decisions at the FCC? Are they biased? What are their qualifications? Request background on decision makers setting regulations state and fed levels both.
- Kent Chamberlin: limits are set very high compared to other countries who do look at biological effects. What can we, as a state do if fed level decision makers aren't qualified to be making those decisions?
- Carol Miller: We should have an industry report for NH. Where are we at for 5G deployment? How can we help mitigate for our constituents?
- Rep Woods: in hearing testimony, has study been repeated? Look beyond credentials of presenter.
- Rep Abrami: Would like to hear from Industry on this. And insurance?
- Kent Chamberlin: Can we look at where policies are done because of exposure to radiation?

- Senator Gray: Insurance writes exclusions because it's an issue or may exclude on Rumor?

VII. Meeting frequency, time & length.

- every 2-3 weeks, initially.
- two hours typically
- next meeting: Thursday, October 10,2019 8:30-10:30
- Kent Chamberlin will do brief presentation on waves.
- will need projector for slides.
- Dr Heroux may present if he is able to be at the next meeting.

VIII. Public comments:

– Jennifer White (Hancock,NH):

1. Jen and her son are RF sensitive. She manages two businesses out of her home. Agree with Senator Gray it is a greater issue than just 5G. However, the issue with 5G is we can no longer have control over the safety of our home/property environment. If that right is taken away, they will both suffer, as their own home will no longer be a safe place.
2. Response to Senator Gray's statement about some radiation is helpful ie. Killing cancer... Jen's mom had cancer. The radiation did kill that. But she lived 3 years longer but died from Leukemia caused by the radiation to kill the cancer.

-Cherylyn Randolph LeBrun: (Loudon, NH): She has background in public health nursing. Her concern is for children and our future children. Please consider the long term effects on exposure to children who will have a much longer exposure than we have. Autism is a big issue. Please focus on pediatric neurology.

IX. Meeting Adjourned at 10:05 am.

HB 522 - VERSION ADOPTED BY BOTH BODIES

2019 SESSION

19-0261
05/01

HOUSE BILL **522**

AN ACT establishing a commission to study the environmental and health effects of evolving 5G technology.

SPONSORS: Rep. Abrami, Rock. 19; Sen. Sherman, Dist 24

COMMITTEE: Science, Technology and Energy

ANALYSIS

This bill establishes a commission to study the environmental and health effects of evolving 5G technology.

Explanation: Matter added to current law appears in ***bold italics***.
Matter removed from current law appears ~~[in brackets and struck through]~~.
Matter which is either (a) all new or (b) repealed and reenacted appears in regular type.
19-0261
05/01

STATE OF NEW HAMPSHIRE

In the Year of Our Lord Two Thousand Nineteen

AN ACT establishing a commission to study the environmental and health effects of evolving 5G technology.

Be it Enacted by the Senate and House of Representatives in General Court convened:

1 New Subdivision; Commission to Study the Environmental and Health Effects of Evolving 5G Technology. Amend RSA 12-K by inserting after section 11 the following new subdivision:

Commission to Study the Environmental and Health Effects of Evolving 5G Technology
12-K:12 Commission Established. There is established a commission to study the environmental and health effects of evolving 5G technology, which includes the use of earlier generation technologies. Fifth generation, or 5G, wireless technology is intended to greatly increase device capability and connectivity but also may pose significant risks to humans, animals, and the environment due to increased radiofrequency radiation exposure. The purpose of the study is to examine the advantages and risks associated with 5G technology, with a focus on its environmental impact and potential health effects, particularly on children, fetuses, the elderly, and those with existing health compromises.
12-K:13 Membership.

I. The members of the commission shall be as follows:

- (a) Three members of the house of representatives, including one member from the house science, technology, and energy committee, and one member from the health, human services and elderly affairs committee, appointed by the speaker of the house of representatives.
- (b) Two members of the senate, appointed by the president of the senate.
- (c) A member of the public, appointed by the governor.
- (d) The attorney general, or designee.
- (e) Two members of the New Hampshire High Technology Council, appointed by the council.
- (f) One member representing the Business and Industry Association, appointed by the association.
- (g) One member of the New Hampshire Medical Society who specializes in environmental medicine and is familiar with electromagnetic radiation, appointed by the society.
- (h) One member representing the university system of New Hampshire knowledgeable in radiofrequency radiation, appointed by the chancellor.
- (i) One member of the cell phone/wireless technology industry, appointed by the president of the senate.
- (j) The commissioner of the department of health and human services, or designee.
- (k) One public member with expertise in the biological effects of radiofrequency radiation, appointed by the speaker of the house of representatives.

II. Legislative members of the commission shall receive mileage at the legislative rate when attending to the duties of the commission.

III. The members of the commission shall elect a chairperson from among the members. The first meeting of the commission shall be called by the first-named house member. The first meeting of the commission shall be held within 45 days of the effective date of this section. Seven members of the commission shall constitute a quorum.

12-K:14 Duties and Reporting Requirement.

I. The commission shall:

- (a) Examine the health and environmental impacts from radiofrequency (RF) radiation emitted from the waves in the 30-300 gigahertz(GHZ) range of the electromagnetic spectrum, which falls somewhere between microwaves and infrared waves, and which are required with the rollout of 5G technology.
- (b) Assess the health and environmental impacts of 5G technology, which requires small cell towers to be placed at a distance of 250 meters from each other at telephone pole height from the ground and will operate in conjunction with the 3G and 4G technology infrastructure.
- (c) Receive testimony from the scientific community including but not limited to physicists and electrical engineers, the medical community including but not limited to cellular experts and oncologists, the wireless technology industry including but not limited to cell phone businesses and businesses working on the development autonomous vehicles which will rely on 5G technology, as well as other organizations and members of the public with an interest in 5G technology.
- (d) Consider the following questions and the impact on New Hampshire citizens, municipalities, and state government of:
 - (1) Why the insurance industry recognizes wireless radiation as a leading risk and has placed exclusions in their policies not covering damages caused by the pathological properties of electromagnetic radiation?
 - (2) Why do cell phone manufacturers have in the legal section within the device saying keep the phone at least 5mm from the body?
 - (3) Why have 1,000s of peer-reviewed studies, including the recently published U.S. Toxicology Program 16-year \$30 million study, that are showing a wide-range of statistically significant DNA damage, brain and heart tumors, infertility, and so many other ailments, being ignored by the Federal Communication Commission (FCC)?
 - (4) Why are the FCC-sanctioned guidelines for public exposure to wireless radiation based only on the thermal effect on the temperature of the skin and do not account for the non-thermal, non-ionizing, biological effects of wireless radiation?
 - (5) Why are the FCC radiofrequency exposure limits set for the United States 100 times higher than countries like Russia, China, Italy, Switzerland, and most of Eastern Europe?

(6) Why did the World Health Organization (WHO) signify that wireless radiation is a Group B Possibly Carcinogenic to Humans category, a group that includes lead, thalidomide, and others, and why are some experts who sat on the WHO committee in 2011 now calling for it to be placed in the Group 1, which are known carcinogens, and why is such information being ignored by the FCC?

(7) Why have more than 220 of the worlds leading scientists signed an appeal to the WHO and the United Nations to protect public health from wireless radiation and nothing has been done?

(8) Why have the cumulative biological damaging effects of ever-growing numbers of pulse signals riding on the back of the electromagnetic sine waves not been explored, especially as the world embraces the Internet of Things, meaning all devices being connected by electromagnetic waves, and the exploration of the number of such pulse signals that will be created by implementation of 5G technology?

II. The commission shall prepare and publish an interim and final report of its findings and recommendations. The reports shall:

(a) Outline the advantages of, and risks associated with, 5G technology running in conjunction with the 3G and 4G technology infrastructure.

(b) Develop a strategy, if deemed necessary, to limit RF radiation exposure from 5G or lesser generation technology relying upon electromagnetic waves.

(c) Include a public policy statement on 5G wireless systems, which either declares the technology safe or outlines actions required to protect the health of its citizens and environment.

(d) Consider alternatives to 5G technology that will accelerate information flow speeds and volumes without the use of electromagnetic waves that emit high levels of radiation.

(e) Provide any recommendations for proposed legislation developed by the commission.

III. The commission shall submit the interim report required under paragraph II to the speaker of the house of representatives, the president of the senate, the house clerk, the senate clerk, the governor, and the state library on or before November 1, 2019, and shall submit the final report on or before November 1, 2020.

2 Repeal. RSA 12-K:12 - 12-K:14 and the subdivision heading preceeding RSA 12-K:12, relative to commission to study the environmental and health effects of the evolving 5G technology, are repealed.

3 Effective Date.

I. Section 2 of this act shall take effect November 1, 2020.

II. The remainder of this act shall take effect upon its passage.

**NH COMMISSION TO STUDY THE ENVIRONMENTAL AND HEALTH EFFECTS
OF EVOLVING 5G TECHNOLOGY**

Meeting held:

10/10/19

8:30-10:30am

LOB 202

Meeting called to order by Rep Abrami at 8:30am.

In attendance: (13) (Each member discussed their backgrounds)

Rep. Patrick Abrami-speaker of the house appointee

Senator Tom Sherman-president of the senate appointee

Rep. Ken Wells- speaker of the house appointee

Kent Chamberlin-UNH-appointed by the chancellor

Carol Miller-NH Business & Economic Affairs Dept.

Denise Ricciardi-public-appointed by the governor

David Juvet-Business and Industry Association

Brandon Garod-AG designee, Asst. AG Consumer Protection

Bethann Cooley-CTIA , trade association for wireless industry and manufacturers

Michelle Roberge-DHHS- Commissioner of DHHS appointee

Dr. Paul Heroux- Professor of Toxicology, McGill University- speaker of the house appointee

Rep. Gary Woods-speaker of the house appointee

Senator Jim Gray-president of the senate appointee

Not present: (1)

Frank MacMillan ,Jr. MD-NH Medical Society Environmental Medicine

Agenda: *(attached)*

I. Approval of minutes from 9-16-19:

-minutes were approved with changes to be made for Rep. Wells name to be corrected and to correct quote attributed to Kent Chamberlin in error.

II. Commission in agreement to broaden out to RF effects beyond just 5G.

III. Dr. Kent Chamberlin Presentation: Electromagnetic Spectrum Physics: (see attached 6 pages)

- All information/data is transmitted merely as 1s and 0s.
- Everything is electrical in the data transmission system.
- Data rate= how fast you can send information= bandwidth, etc.
- The higher the data rate, the higher the frequency.

- Frequency is inverse relationship to wavelength. Increase frequency, the shorter the wavelength.
- The data rate can be no faster than half the speed of the oscillator for acoustic transmission. Therefore, data cannot be sent very quickly at low frequencies.
- Two fields are generated: Electric and Magnetic fields in electromagnetic transmission.
- Antenna converts voltage to E/M waves or the reverse.
- Wavelength is distance from peak to peak of the wave. The lower the frequency, the greater the wave length, the larger the antenna needed. Need high frequency, shorten wavelength to have smaller antenna.
- We need high frequency for high data rate for small antenna for mobile devices.
- 2.45 Ghz Industrial scientific Medical band.
- 800 Mhz-2.7 Ghz currently for cell phones same as microwave oven frequency.
- 5G is proposed to be 86 Ghz, significantly higher, close to the invisible spectrum.
- Photon Energy =frequency x Planck's constant= to find energy in photons of the frequency.
- Wave particle duality which is part of quantum physics is important to look at for health effects.

Sherman: why doesn't my cell phone fry my hand like a microwave oven if I put my hand in it?

Chamberlin: 1.5 Kw for a microwave is more watts of power than your cell phone. Power drives the heating. Increased power increases photons but energy remains constant. We need to look at Quantum Physics and photons.

Rep Abrami: non ionizing vs ionizing?

Chamberlin: We need to look at photons for that. EMR can be represented as discrete packets of energy called photons. If photon energy is great enough to detach electrons from molecules, you have ionizing radiation or heating, if power is great enough. It is a fuzzy line between ionizing vs non ionizing radiation. You will have heating if thermal radiation from microwaves is strong enough.

Sherman: if visible light is that far along the spectrum, why isn't it damaging?

Chamberlin: We know that it is. You are also exposed to UV rays in light like sun or tanning beds.

Woods: Can it be damaging but non-ionizing?

Wells: yes...an example of an egg frying.

Woods: Proton tunneling- protons go from one side to other of DNA which creates a misread or error. Non-ionizing is in that category because hydrogen bonding can be flipped during proton tunneling. Quantum physics. There is a probability it can go through the energy barrier. Be aware, because there are other mechanisms by which energy levels can be damaging but non-ionizing.

Chamberlin: EMF simulation- if we increased the wavelength and it strikes something like wet wood, some of the energy reflects back like radar. Some of it gets transferred into the wood or object. The wave is getting smaller as it enters because it gives up heat and warms the wood. You get heating from within and you do get heating from the outside.

Sherman: Does impact of reflected wave change the amplitude of the incoming wave?

Chamberlin: Yes. It causes a partial standing wave.

-High frequency supports higher data rates and allows for designs of convenient sized devices.

-Relatively (600 mw to 3 watts) low power of cell devices, supposedly won't cause heating.

- Signal loss increases with increasing frequencies which is why they need to be so close to towers.

-Cell phones adjust power output as needed. Cell works harder if signal is weak or antenna is covered. It will pump more EM energy into the user. (22-45 miles) typical cell power distance ranges.

The closer your cell phone is to your body, the power is significantly greater. What goes through someone's head while talking on cell phone? It uses your head as a ground plane before radiating outside, standing waves and resonances within cavities like sinuses. This isn't good. We need to ask. If it's harmful, what can we do about that?

Sherman: Are you saying that human tissue becomes part of antenna or diffuses power into tissue?

Chamberlin: Yes. Your head acts as antenna or ground plane. It excites current inside your skull and causes heating. Is it significant heating? I don't know.

Abrami: original studies in 1990s studied thermal effects. Studies say potential biological effects. As a Commission, we will be about science, not speculation.

Wells: Besides ionizing or non-ionizing radiation, other photo chemical reactions are at play. For example, vitamin D or Plastic beach balls out in the sun. The red ones fade from photo chemical reactions. It is consequential.

Sherman: Seacoast terrible cell service. Does that mean cellphones work at higher level than Manchester? If that's the case, are we getting more of one kind of EMR from cell tower? Or cell phone?

Chamberlin: If cell tower is far away, will not get constant radiation. However, your cell phone will give off higher radiation because it works harder to find the signal. But, we can choose to have a cell phone off or not radiation constantly.

Cooley: with small cells, your phone battery is not working as hard to find signal and works at lower power.

Sherman: what are you getting in exposure from that closer infrastructure?

Chamberlin: which is worse? Short high bursts? Or constant low level doses?

Roberge: On your slide, the higher the red in the brain, the higher the intensity?

Chamberlin: yes.

Denise: Does that explain the rise in brain cancer?

Chamberlin: It's a correlation but is that causation? I don't know that answer. We need to look at epidemiology.

Wells: Brain Cancer and reproductive organs don't require big voltage to affect.

Woods: much of our tissue is ionized and that is a natural state. Your bones don't grow or heal unless you have an ionized state. Biological tissue can operate in an ionized state.

Abrami: Some say it's safe because it's non-ionizing. But is that a true statement? That's why I bring that up.

IV. Dr. Paul Heroux Presentation: Biological Effects of RF Radiation: *(see attached 6 pages)*

- Occasionally, we make mistakes in public health with uncertainty. Because we did not recognize accurately the danger, In 2007, we changed chromium 6 from 100 to 5 which is a factor of 20 that we misjudged safety. Workers under the old limits have 35% chance of cancer from exposure. The new limits reduced to 4.5%.

-Risk is a part of life. We cannot have zero risk. Important to realize that legal exposure limits are what is known at the time, for the exposed population, and if there are the alternatives should be part of risk assessment for an agent.

-EMR standard came about after second WW. U.S. was the only country to produce a standard because they were the only ones who had that capability. The military was the source of deciding that heat would be the criteria.

- Navy, Air Force, Army: EMR enormous importance in time of war... would need radar to survive. Applications involving military were given high priority at that time. Colonel George Knauf of USAF and Dr. Herman Schwann, bio-physicist, were those making decisions. At that time, it was perceived as non- patriotic to suggest any ban of use of Emfs because of Cold War with what was considered a nefarious power. People gave green light to military which was understandable at that time.

-Debating the danger of microwave: 1960-1990. There was a rift in science at that time.

-Biophysicist, Dr. Herman Schwann, using physics thermal guidelines for heating experiments with short 30 minute exposures. His understanding was limited at that time.
-Biologist Allan Frey used biology based guidelines, microwave hearing, blood-brain barrier leakage and chronic 24x7 exposure. Some research was fabricated to discredit his work.

Military point of view: yes there is doubt to risk but people in service get hurt all the time. So we err on side of keeping armed forces with best technology available. Lots of things are acceptable in times of war.

USAF standard from 1960 survived more or less in this form as standard today in the US. Interestingly, USAF was 10mW/cm²; General Electric was 1mW/cm²; Bell labs was .1mW/cm² and the Soviets .01mW/cm².

Soviets based their standard on nervous system disturbances, not heating. They provided two standards; a higher standard for their military and much lower standard for domestic applications.

The US did not accept this difference. USAF, ANSI, IEEE, FCC...standards still based on heating... as being the only dangerous agent. It's not easy to measure real exposure in high frequency. This limited capabilities for biologists to be part of this process.

1966 Health Standards were ultimately developed by 15 people: 10 from military, 1 oil, 1 space, 1 General Dynamic, 1 US Treasury and only 1 from Public Health.

Very heavily biased to applications vs biological affects... are exposures for fighter pilot in F16 appropriate for children in classrooms today?

In commerce and engineering, people are highly motivated to promote product. If someone says, maybe there is a subtle affect related to your product that you have not investigated, most companies will not have the desire nor resources to do so. This is not a recent story. Adam Smith...warned if merchants have their way, they will act in such a way to promote their product... beware. This has lead in the past to public health issues:

-Air pollution is one of these. Air pollution is visible. However, no one realized it until 1952 when 12,000 people died in four days...and that was what finally motivated people because it was obvious.

-Lead: 1930s. They knew at the time it was toxic and GM could have decided to use ethanol in fuel but they knew it could not be patented and you could not make more money. The company decided to use lead instead. You may not die immediately, but your civilization will be inferior as a result... 15 million US children lost 10 IQ points as a result of that decision.

-We should use alternatives, if they exist for public health.

-Today an average of three hours a day are spent on mobile phones, texting and internet access. The cell phone has been an incredible success. Schwann or the Colonel did not anticipate the situation we are in right now. This explosion in constant exposure should have changed the risk assessment today.

-We are being exposed to chronic man made waves in a very short span of time. The reason we adapted to the radiation of light is we have had millions of years to adapt. What is less certain is if we are resistant to other forms of radiation like man made technological radiation.

-RF exposure and Low Frequency exposure: all signals that carry data, function in bursts. Many biological effects we detect, refer to modulation at LOW FREQUENCY (non thermal and non ionizing). This is important.

What evidence do we have that this radiation is biologically active?

*Altered enzyme activity, biochemical changes, Oxidative Stress (ROS), pathological cell changes, neuro-behavioral effects, DNA damage, Altered Gene Expression, Brain wave changes. (hundreds of research papers)

- Currently, 44% of the world is living under much lower standards vs. US and much of the western world which have the highest standards allowed.

-How did IEEE react to these facts?

Engineers had the notion that public health people are trying to get grants based on the success on the telecom industry. There was a great deal of suspicion as they used research unfamiliar to them. Public health people, doctors and biologists realized they could not bridge the gap between engineering and health.

Dr. Carpenter designed the Bioinitiative Report to establish a better standard. But this group is lightweight compared to interests of industry. Academics are a loose group with very limited means and the results had very little influence. The situation is starting to change in Europe in particular in allowing the exposure to humans.

What is 5g? What does it mean?

-Slice spectrum into tiny bands changing 12.5 times per second your cell phone can change frequency.

- Time domain multiple access in bursts.

-Space segmentation...instead of broadcasting in every direction use narrow beams, 3-10 degrees in width. Tom Wheeler of FCC said it's a wonderful new idea ...but Russians had in 1981 most sophisticated radar... already in military long time ago but what is new is beam steering and beam focusing. This results in a lot more radiation and information being broadcast for the Internet of Things. (IOT)

- Noise is important. IOT seems like a great idea but it will be a self-fulfilling prophecy. It will be difficult to extract information from all the noise from all the waves constantly radiating.

-Some people think less penetration in the body will result from 5G...but UV causes skin cancer at penetration of .1mm which is less penetration than 5g.

Abrami: pulsing?

-Amplitude modulation... allowed us to send voice over large areas... modulated with voice of person. When FM came along, this allowed us large amount of stations but you had to allow more power. Then, we changed from analog to digital or data as it can be compressed. Now, it is sent as pulses. Are pulses more negative affect than waves? All indications are that they are more biologically active. The irregularity of the pulse creates a challenge to the organism. The organism is hit vs being pushed. Irregularity of the challenge to organism is important.

-3G/4G cell phones... we had a lot of exposure to these pulses. These bursts are so useful that this was not taken into account. You do not want your phone to use high frequency all the time so you can save power.

Sherman: The difference between 10Ghz and 50Ghz is less penetration but is there increase in intensity of penetration?

Heroux: Yes.You will have more concentration of energy.

-Caution: Phone industry wants to get rid of SAR because they won't be able to sell them because that concentration will raise the SAR above the limits. They will be illegal. They will say power density should be the new standard. All that will do is change the location of the cancer in the body as it will be more concentrated. Regulators are coming from the industry to set standards for their products.

- RF in cars is a public health threat. They will become radiation intensive. Companies are more concerned about "features" in car vs the biological effects.

-IOT is dream of engineers to put RF in anything that you can get information from. But they are also taking information from people without authorization.

-We want the capacity but should a company be able to put that in a product without my authorization or knowledge? It has to be controlled.

Abrami: Can you touch on autonomous vehicles? Colleges have grant money to look at it.

- It is NOT TRUE you need 5g for autonomous vehicles.

-Vision and laser scanning are being done at MIT. You need very rapid scanning but it is being developed.

-Engineers are smart. If we tell them to do it safely, they will.

-You don't need 5g for remote medicine although they will say you do because of low latency.

-In terms of humans, low latency does not mean much. It means a lot in a process in a plant or with robots, but not humans.

-Is it possible to non thermally affect cancer cells? Yes. Dr. Heroux's research.

- ALL cancer cells react to artificial EMFs.

-Low level radiation, similar to cell phone at low frequency have same or higher power of oxygen that can affect the body. O2 is fuel for body that generates ROS but we need O2. However, fields that produce larger effects like cell phones, we can CHOOSE not to have.

-Organs that need the most oxygen are most affected. Cells die more by necrosis than apoptosis.

- In 1900s rates of disease and chronic disease very different than what we have now.

Abrami: has your research been replicated? Yes... there are hundreds of research papers to support this.

Cell necrosis vs fibrosis:

Sherman: necrosis (cell death) to fibrosis (scarring)

Tissues most at risk...are brain, pancreas which has high levels of ROS already, diabetes.

-Non thermal effects... RF changes behavior of cells..... which is why we talk about children and digital RF exposure in their lifetime. There are places now eliminating wifi from schools.

-Pregnant women, infants, children: cells replicate quickly, developing tissues are vulnerable, microwaves penetrate young brains more deeply.

- Reproduction and sperm counts are very serious subject but I do not have time to cover all effects.

-You don't need energy to affect biology, they are already ionized.

- According to Prof Martin Blank: DNA becomes unstable from EMR.

Our bodies are electrical machines...the movement of protons tunneling and effect on ATP synthase, which is one of the most sensitive places in the body result from EMR.

-Importance of cell phones are so great people are not willing to act on risk. We need to find a way to maintain function and minimize the risk.

-If you expose brain to EMR: penetration of albumin in brain= egg white which carries toxins so now you have toxins carried into the brain. Alan Frey detected permeation of blood brain barrier. The lesions were occurring have pattern have no connection to simulation by a physicist. It means there is penetration of albumin into the brain. 50% of protein in blood is albumin. It is used to capture toxicants of all sorts so your body is not affected too rapidly. It captures it and releases slowly so you aren't shocked. When albumin goes into brain, it carries all toxins that you carry in body into your brain. It is not a good thing and happens in a very short time.

Ramazzini & NTP studies.... Yes... DNA damage & cancer particularly, in nervous system.

Wells: EMR studies with plants? Yes...There is a lot of literature even with visible light. The visible light is not a grave problem because we have evolved over millions of years... tissues can adapt over time...rapid changes we cannot adapt to.

Abrami: We ran out of time. Dr. Heroux, you may finish your presentation at our next meeting.

Next meeting will be Thursday, Oct 31st at 9 am.

Nov 1st, first draft report due

V. Meeting Adjourned at 10:30 am.

**NH COMMISSION TO STUDY THE ENVIRONMENTAL AND HEALTH EFFECTS
OF EVOLVING 5G TECHNOLOGY**

Meeting held:

10/31/19

9:00-11:15am

LOB 202

Meeting called to order by Rep Abrami at 9:00 am.

In attendance: (12)

Rep. Patrick Abrami-speaker of the house appointee

Senator Tom Sherman-president of the senate appointee

Rep. Ken Wells- speaker of the house appointee

Kent Chamberlin-UNH-appointed by the chancellor

Denise Ricciardi-public-appointed by the governor

David Juvet-Business and Industry Association

Brandon Garod-AG designee, Asst. AG Consumer Protection

Bethanne Cooley-CTIA , trade association for wireless industry and manufacturers

Michele Roberge-DHHS- Commissioner of DHHS appointee

Dr. Paul Heroux- Professor of Toxicology, McGill University- speaker of the house appointee

Rep. Gary Woods-speaker of the house appointee

Senator Jim Gray-president of the senate appointee

Not present: (2)

Frank MacMillan, Jr. MD-NH Medical Society Environmental Medicine

Carol Miller-NH Business & Economic Affairs Dept.

Agenda: (attached)

I. Approval of minutes from 10-10-19:

-minutes were approved with changes to be made for proper spelling of Bethanne Cooley and Michele Roberge.

II. Webex (NIEHS) National Toxicology Program Study Presentation

Presented by Dr. Michael Wyde, toxicologist and Dr. John Bucher senior scientist and former Director of NTP Division, in the Division of the National Toxicology Program at the National Institute of Environmental Health Sciences (NIEHS), which is a part of the National Institute of Health.

- Interagency program (NTP) was established in 1978 with the: National Institute of Environmental Health Sciences, National Institute of Occupational Safety and Health, FDA (National Center for Toxicology Research).

- The NTP's mission is to evaluate agents of public health concern by developing and applying tools of modern toxicology and molecular biology.
- Their scope of work includes: research and testing agents of public concern; conduct literature-analysis activities to identify cancer and non-cancer human health hazards; develop new approaches to better predict how agents affect biological responses and communicate results to multiple stakeholder groups through technical report series, journal publication and the NTP website. (<https://ntp.niehs.nih.gov>)
- In 1999, the USFDA nominated radiofrequency radiation (RFR) of wireless communication devices to NTP for study.
- At that time, there were 100 million users. Today there are over 310 million Americans and 5 Billion worldwide, exceeding the number of people.
- Biological effects have been reported in cell-based tests and in laboratory animal studies. However, animal studies have not consistently demonstrated increased incidence of tumors at any site associated with exposure to cell phone RFR in lab animals.
- There are challenges and logistical issues associated with RFR study.
- According to FCC, RFR limit is 1.6W/kg. Needed to design a new way to expose to RFR for research. Study focused on 2G and emerging 3G technology at the time.
- Used reverberation chambers as recommended by National Institute of Standards and Technology (NIST): shielded room with RF antenna distributing frequency into the room with uniform exposure. The benefit is that they could control and monitor the exposure.
- Three phase study: 5 day, 28 day and 2 year, alternating on/off for ten minutes at a time and exposed to GSM and CDMA signals for both mice and rats.

NTP Findings:

- NTP's study on cell phone RFR is the most comprehensive assessment of health effects in rats and mice from exposure to 2G and 3G cell phone RFR.
- There was **CLEAR EVIDENCE** that exposure to cell phone RFR caused malignant schwannomas (heart tumors) in male rats.
- There was **SOME EVIDENCE** that exposure to cell phone RFR caused malignant gliomas (brain tumors) and pheochromocytomas (adrenal gland tumors) in male rats in addition to positive findings of DNA damage to hippocampus and equivocal findings in frontal cortex.
- In mice, equivocal evidence of carcinogenic activity in both male and female and positive findings for DNA damage in the brain in males and blood cells in females.
- Positive findings for lower weight babies exposed in utero for rats and at five weeks for mice.
- NTP uses a 4 level scale: no evidence, equivocal evidence, some evidence, clear evidence.

- Final conclusions represent the consensus of NTP and a panel of external scientific experts who peer reviewed the studies at a public meeting on March 26-28, 2018. Two technical reports: TR 595 (2018) and TR 596(2018) Note: these findings should not be directly extrapolated to human cell phone usage because they were done at higher exposure and to the whole body during research.
- NTP Publications published in journals: 2017 in IEEE and in Bioelectromagnetics in 2018.

Goals for further study:

- Address issues raised in peer review and do follow up studies.
- Smaller scale exposure facility and quicker time frame to get data out.
- Use newer technology: 3G and 4G
- 5G uses different modulation schemes and frequencies above 60Ghz which behave differently.
- Evaluate DNA damage, establish biomarkers of exposure and probe biological mechanisms for RFR induced effects.
- What role does DNA damage and repair play?

Questions:

Abrami: Was the level 1.6W/kg in 1999? Is it the same today?

Wyde: Yes. It is based on acute exposure based on tissue heating. NO changes have been made in twenty years to the standard.

Abrami: If current standard is 1.6W/kg, where did damage start at the three levels you tested?

Wyde: Heart tumors were significant at 6W/kg showing clear evidence with some at lower exposures.

Abrami: That is well above the standard of 1.6W/kg and I am assuming phones are lower.

Wyde: Theoretically, 1.6 W/kg is the limit for phone which is what device is allowed not the exposure to people. New evidence is that SAR from phones is actually higher than 1.6W/kg. Part of that is because phones are not supposed to be next to your head.

Chamberlin: Reverberation chamber to have homogeneous 1.6 W/kg exposure, but how does that correlate to holding phone next to your head for a human?

Wyde: You have pin point exposure to the head but we don't have data on what that exposure is to all areas of the body at the same time. This is why we can't directly apply results to humans.

Chamberlin: Frequencies for 5G. You mention 60Ghz but I heard 87-100Ghz which is much higher. That is significant. We also have Beth here from industry.

Wyde: I defer to the expert. I am not aware of any intention to move above 60Ghz.

Cooley: I am not allowed to be privy to future deployment plans as a rep for CTIA. I only have information that the public has because of antitrust laws.

Sherman: When we are in a network of wifi/phones like we are right now, is there a certain level of radiation we are exposed to without even using our cell phone?

Wyde: Yes. That is one of our concerns in an increasingly wireless world. What is our background level of exposure when we are sitting in a room surrounded by people with cell phones or a school with wifi? The way we use devices has changed. It's not just a cell phone. Actual exposures is important, not just what a device emits.

Sherman: So to get to 6W/kg in a human holding a cell phone to their ear, could they get to that level or exceed it? Or is it well beyond any potential exposure a human would have?

Wyde: That exceeds what a device is capable of. But independent studies have looked at that showing it exceeding 1.6W/kg.

Sherman: Does exposure increase with increasing 2G, 3G,4G and 5G capable phones?

Wyde: no. the G means generation. (Woods, Heroux shaking heads...YES it does)

Gray: Does the energy emitted by antenna that is absorbed fall off as a cubed function?

Wyde: No, not cubed but squared.

Gray: Area is two planes, three dimensional is cubed. I would think it would fall between those two planes. I will explain later why I asked the question.

Wyde: That is not our area of expertise.

Chamberlin: I am not sure it's relevant.

Wells: Talking about intensity of field as opposed to photon energy. Photon energy definitely goes up as frequency increases.

Ricciardi: DNA damage was found without a degree of body temperature change which means non thermal effect. The FCC limits say that one degree of body heat is considered thermal heating. So what does that say about the FCC limit? Does that mean that this is harmful?

Bucher: That's one of the things we need to look at in the future. One idea is that there is an inhibition of the repair process. DNA damage happens all the time and is RFR slowing rate of DNA repair? We need to look at that.

Ricciardi: I am still not clear. Your study was designed to test non heating damage. You found damage so doesn't that mean that FCC assumption that only heating can cause damage is incorrect and no longer accurate? Would you agree?

Wyde: A lot of people believe unless you heat tissues, you won't see health effects with RF. This study disproves that as we did not have over heating but we did see damage.

Abrami: Dr. Chamberlin hopefully will bring in someone from IEEE to help us understand how they developed those standards.

Sherman: Was there any way to determine cumulative exposure rather than dose related? Or did you not look at that?

Wyde: We did not look at that when we designed studies.

Woods: Question on the structure of cages? What was it made of? Were they metal? They look like a faraday cage. Where was RF measured?

Wyde: That's a very good question. The chamber is stainless steel. Anything in the chamber was non metal so it did not affect the signal. We did not want to heat anything or cause problems for the animals. NIST took measurements to make sure there was uniformity in the whole space.

Abrami: what is a faraday cage?

Woods: Faraday cage is a metal mesh network that prevents RFR exposure to what is inside.

Woods: Why did you use rats and mice? Why were rats started in utero and mice at five weeks? Any animal is much more sensitive in utero to damage. How much of result was attributed to in utero?

Bucher: Traditionally, all cancer studies use both rats and mice. We only use in utero exposure with rats because it's harder to use hybrid mice in utero. By using both, we get more information than we would normally.

Wyde: Part of the reason for in utero, is it mimics human exposure in utero.

Roberge: Were you able to see the difference where health effects occurred, with regard to various levels, knowing your exposure was above the 1.6W/kg that a device is permitted to emit?

Bucher: We need to backup and understand what we were trying to do. We needed to make sure we did not use thermal limits more than one degree of body temperature that animals could tolerate. Different sized animals absorb different amounts. Rats because they are larger, could only be exposed to lower levels because we saw the largest response on the largest animals. They were affected more with strongest responses to RFR.

Roberge: Are you looking at synergistic effects of multiple frequencies in your future studies? Does that influence exposure?

Wyde: yes that is part of what we are looking at. How are people's exposures going to change with 5G? That's very important as we move forward.

Chamberlin: Are the signals realistic by alternating regular modulation, since it's not realistic compared to the pulsed or bursts we are exposed to now. Cell phones don't radiate continuously. Did you look at that?

Wyde: We tried to create scenarios with spikes and ten minute on and off exposures. We had modulating patterns that would mimic conversation on cell phones. We tried to create relevant exposure scenarios.

Bucher: We used actual GSM and CDMA signals that spike. GSM modulation when signals are sent only 1/8 is the spike. That is what we used.

Abrami: Legislators are being faced with push back on small cell towers with 5G at street level and every 250 meters apart with millimeter waves.

Bucher: We are keeping close eye as 5G emerges.

Heroux: NTP study was designed quite a long time ago. Our situation is that we deploy things and the time to assess health impacts is much larger than rapidly evolving technology.

Sherman: Can you recreate background daily exposure to what we might anticipate by increased number of 5G towers in a neighborhood using this model? I would like to know BEFORE deployment.

Wyde: The technology is not capable of doing that with 5G frequency.

Bucher: Our exposure depends upon how we are positioned with respect to antenna. To study 5G and combine with lower level exposure, is an enormously difficult scenario to recreate.

Wells: For base station towers 250 feet apart, the energy density is 5x higher than a cell tower. The depth of penetration in tissue, the higher the frequency have higher photon energy, the amount of energy being absorbed in a thin layer is significantly higher. Would you agree?

Bucher/Wyde: yes. We would agree. But power levels are lower.

Ricciardi: power levels are lower but it's in close proximity 24 hours a day, which is microwave radiation. Would that not heat tissues over time? If so, would we assume 5G would not be safe?

Wyde: No. Our exposure is a function of distance and power levels and other factors. At this point, we don't know.

Chamberlin: Your category, Clear Evidence. Can you compare that to relative risk?

Wyde: No. clear evidence is a descriptor we use in our cancer studies. It does not relate to relative risk in the human population.

Chamberlin: Are you using P value of .05 as statistically significant value?

Wyde: We look at .05 as cutoff as statistical significance but often the clear evidence findings have a lower P value.

Sherman: We should get their peer reviewed articles. They may have more data in them.

Chamberlin: It would be nice if they could compare it to smoking or something.

Ricciardi: There is an online library at: <https://onlinelibrary.wiley.com> They just published new findings in October.

Woods: We need to be cautious because we cannot make one to one correlations with humans when we look at these studies. For example: if aspirin (djoxin) was tested today, it would be banned because it causes cancer in mice and rats. So we need to be careful when looking at these studies. Is there a significant difference between a rat and a mouse?

Sherman: We have to be cautious before we extrapolate to humans but we can't test humans without a long period knowing their cumulative exposure. You can't recreate it because it takes 20 years for people to die before we know anything. Hopefully, we will take as much evidence as we have. Because what we have seen in other industry settings with contaminants, we don't know until a lot of people die. They cannot recreate this in a lab. It's a warning on both sides.

Woods: We have to be able to say, we don't know. Some of the other literature, they were criticized for poor standards.

Ricciardi: Ramazzini Institute studies duplicated that study, using very low standards.

Wells: These are very difficult studies to do. The human body is an antenna. Larger animals are more exposed. Humans are much larger than mice or rats. They are studying critters smaller than the wavelength. When we talk about base stations for 4G transmitting at 100watts but KM away, that is much less than the magnitude of intensity from 10's of meters away of 5G antenna, even if it's only 7 watts. A flaw in this study is that they are treating them as chemical exposures. The room has a uniform feel but when it hits the skin, it's no longer uniform. Penetration depth is important. With 5G that's a very thin piece of tissue getting a lot of penetration. It's difficult to study.

Heroux: Mice and rats are only superficially similar. They are used because they are cheap, easy to handle. We know they are different and provide different information. Toxicologists know about these things. That is why they design a model on how to use animals in these experiments, which is extremely complex.

Cooley: What is on the towers is not line of sight technology. Small cells are. They are not beam forming. We will talk about this at future meetings as well.

Sherman: I have a comment on autonomous vehicles. People claim you need 5G for those. My nephew is one of the lead engineers for the Google vehicle, Waymo and he said the very definition of “autonomous” is autonomous. It does not or should not need wireless or power networks to depend upon. I don’t think the ongoing claim that autonomous vehicles need 5G, is true.

Heroux: I agree MIT as well has a car that does not rely on 5G. There are many ways autonomous vehicles can operate using: vision, laser scanning, ultrasound. EMR is not required.

III. General Discussion:

We will hear from Prof. Eric Swanson, U. Pittsburgh provided from Bethanne Cooley at the next meeting: Thursday, November 21st at 8:30am.

Interim report: Agreed upon with correction for non-ionizing statement to reflect properly Ken Chamberlin’s opinion from his presentation.

IV. Frank Clegg Video: Framing the Issue:

- Former CEO of Microsoft Canada, 40 years in technology sector.
- Current implementation of wireless is not safe.
- 5G is not tested.
- Millimeter waves are used by the military for crowd control.
- We are advocates for safe technology, not, no technology.
- FCC is made up of previous telecom, lawyers and engineers not doctors.
- No oversight provided by FCC. Telecom industry is self-policing.
- 1996 Telecom act prevents anyone from suing Telecom for health injury.
- Countries like China, Russia, Italy and Switzerland have safety limits 100x safer for citizens.
- Today we have significant exposure in our homes, schools, work and public spaces.
- Many states and cities are questioning safety, while the Federal Govt and some other states are fast tracking 5G.
- Many health and mental health effects, including permanent DNA damage.
- Individual, state and local rights are being passed over to telecom industry. That is a significant and historic power shift in rights. Telecom has over 500 lobbyists.
- Swiss RE has designated 5G as a significant insurance risk.
- Convinced there are safer alternatives available so we can have technology safely.
- We need to advocate for change to allow industry to become more responsible.
- Most important thing you can do is to get educated and educate your family, friends, co-workers, state, local and school officials. Knowledge is power and your power is in your hands.

Abrami: If anyone has any questions for Frank Clegg, we can contact him to talk with us.

That video encapsulates a lot of the issues we are dealing with here.

V. Dr. Heroux Completion of Presentation of Biological Effect:

-Human evidence: two documents that are very detailed human evidence: ELF (power systems) and RFR(communication). Both classified both high and low as possibly carcinogenic Class 2B. IARC repeats old notion that there is no mechanism that supports this. They are great epidemiologist but not cognizant of other things. Anthony Miller is worried about rollout of 5G because he is seeing an increase in student 15-19 increase 1%/year in lethal brain tumors. He would like IARC to go back to reclassify because IARC said there was a lack of animal studies but there are many studies which was the reason for the Class 2B. How many will they ignore? He would like it classified as a class I carcinogen.

-Another study shows with a cell phone one and off, that glucose metabolism is increased in the brain when cell phone is on. This is not thermal or heat related but it is an effect.

- Also troubling evidence on increasing gray matter changes.

-Hypersensitive: those who feel its impacts. In Finland, there is software to plot a path from where they live to where they want to go to minimize exposure to radiation. This software has been downloaded 200,000 times. These people are very real. Contrary to what a lot of the medical community is telling them, it's not in their mind. They are physical reactions and not everyone has same effect, nor should they. That is typical of medicine. One of the reasons is that many of them have variants in Glutathione enzyme which is a major detoxifier. EHS people have variations in this enzyme 10x higher than non EHS. Genes will not allow them to produce effective versions of glutathione transferase. The next generation will likely be more sensitive if both parents have this variant. You see a lot of people with EHS, who also have multiple chemical sensitivities because they share the same detoxification mechanisms.

- Proton tunneling: basic mechanism of action of EMR on tissues. Ionizing argument is beside the point. Biological systems are ionized. This is relevant. Stability of materials is an illusion. Every molecule of water decomposes and recomposes. PH of pure water is 7. This is based on the mobility of protons. In every living system, mobility of protons is very important.
- - Oxidative phosphorylation is arguably the most important process in the body. Science did its work on this very quickly after concerns of EMFs on this process. Essential mechanisms of action were discovered of EMFs but ignored. A group of enzymes from 1-5 synthesize ATP. Protons and electrons have to move through our body. EMFs affect the movement of these affects function of enzymes. When protons and electrons are free, they are vulnerable to EMR especially ELF components. Within Mitochondria, you have a PH of 1. You have the highest electric field. If you apply EMF to this system, you disrupt the flow of electrons and mainly protons. Entry channel is completely hydrophilic. It has the same structure as ice and the way enzymes work is proton tunneling. Through this, the proton is vulnerable to fields as small as 20 nano-tesla as

confirmed in experiments. This is very vulnerable to EMR. The semiconductor industry has devices that work on the same principle. If you reduce ATP activity, electrons have to jump across distances and are vulnerable. There are 400 publications that talk about these effects on enzymes from EMF. These electrons form ROS (reactive oxygen species) and have a hard time functioning. The jumping of charges from one place to another creates a lot of room to interfere with propagation of electrons that support metabolism of cells. The science behind tunneling mechanism is... If you have a quantum of energy of any frequency, you are going to have a change in probability to jump from one place to another. This happens at levels way below thermal levels of FCC.

At Duke University in 1985, research showed changes the function of mitochondria but he was ignored. Nobody reads science or a paper unless someone needs them. The mechanisms and science are there but they are unknown.

I agree with Frank Clegg. We can get everything we want. You don't to fear you will lose your cellphone or go back to the dark ages. We can do this very well. We know engineers can do this.

Woods: Buran zones are happening at mitochondria level.

Sherman: Can we get the digital link to the slideshow?

Abrami: We have a website now where all info is posted.

Sherman: When you talk about impacts at exposure much less than our limit, does is increase cell death in terms of end organ damage?

Heroux: Biology is an electrical motor. We are electrical. Any field is possibly going to interfere with this.

Heroux: I exposed cells to radiation and see how cells died. It's not to kill them but does it change how they die by being exposed to EMF. If you compare the power of fields in everyday life, their ability to kill cells is higher than oxygen, creating ROS. ELF component of Telecommunication signals is a significant component.

It increases cell death and diverts cells toward necrosis vs apoptosis. The cell doesn't have enough (energy) ATP and it gives up and goes into necrosis. EMF has power to increase ROS leading to chronic diseases with inflammation like Alzheimer's and Diabetes. So why add on to the load we already have with ROS? We can control electric and magnetic exposure. If you ask at a hospital how many Parkinson's, are related to EMF exposure? They say none and claim EHS people don't exist at all. It is a part of chronic illness. I am not saying it's all of it but it is a part. We have just gotten used to these illnesses. If you can decrease diabetes 20% by reducing this effect, you will save a lot of money in medical care if you address this issue.

V. Meeting Adjourned at 11:15 am.

**NH COMMISSION TO STUDY THE ENVIRONMENTAL AND HEALTH EFFECTS
OF EVOLVING 5G TECHNOLOGY**

Meeting held:

11/21/19

8:30-10:35am

LOB 202

Meeting called to order by Rep Abrami at 8:30 am.

In attendance: (11)

Rep. Patrick Abrami-speaker of the house appointee

Rep. Ken Wells- speaker of the house appointee

Kent Chamberlin-UNH-appointed by the chancellor

Denise Ricciardi-public-appointed by the governor

Brandon Garod-AG designee, Asst. AG Consumer Protection

Bethanne Cooley-CTIA , trade association for wireless industry and manufacturers

Michele Roberge-DHHS- Commissioner of DHHS appointee

Dr. Paul Heroux- Professor of Toxicology, McGill University- speaker of the house appointee

Rep. Gary Woods-speaker of the house appointee

Senator Jim Gray-president of the senate appointee

Carol Miller-NH Business & Economic Affairs Dept.

Not present: (3)

Frank MacMillan, Jr. MD-NH Medical Society Environmental Medicine

David Juvet-Business and Industry Association

Senator Tom Sherman-president of the senate appointee

Agenda: (attached)

- I. Approval of minutes from 10-31-19:
-minutes were approved with comment from Rep Woods.

- II. Dr. Eric Swanson: University of Pittsburgh, Professor of Physics Presentation
(Here at the request of CTIA but the opinions are his own)
 - There is a lot of misinformation and misunderstanding out there + fear of the unknown= trouble.
 - Fear of the unknown is what links past worries like power lines and radio waves causing cancer cellphones killing honey bees to the current ones about 5G and cellphones.
 - Millimeter waves (similar to 5G) are used in Russia therapeutically for over 50 diseases.
 - It is not plausible that the same radiation can both cause and cure 50 diseases. It does neither. It does nothing.
 - It does not affect living things: and I have two main points.

Ricciardi: Experiments with 5G on bees show that bees are affected. Bees absorbed more with higher frequencies.(Scientific Reports: 2Ghz-120Ghz). This could lead to changes to insect behavior over time. Can you confirm based on scientific evidence that these frequencies are safe for pollinators? What credentials do you have to speak to this?

- Swanson: It's scientifically not plausible that these waves have any effect on ANY living thing. Biochemical response of a bee cell to EMR is the same as a rat cell and a human cell. That is my scientific opinion. It's true that EMR does not do nothing.
- As far as credentials... There are two aspects:
- 1. The radiation itself: we understand perfectly since 1875. There are no questions and no ambiguity. This is where I come from.
- 2. The biological response: it's difficult to measure. It's complex and messy. We can explain it all with general physics terms, not fancy biological terms.

Heroux: The IEEE standard is based on resonance between dimensions of humans and for example (70MHz) frequency of radiation. Frequencies that match the size of the bees, the transfer of power will be increased by a large factor. These parameters have been recognized by engineers, physicists, etc. not just biologists. They fly everywhere, not walk on the sidewalks and are likely to go to areas where power densities are very high. In my opinion, you are not showing much concern for the small pollinators that we need to survive.

Swanson: I disagree with everything you said. If you want I can go into details of why. Resonance is in fact related to size of important bio mechanical mechanisms inside of cells. There is a famous paper by Robert Gadera (sp?) from twenty years ago showing these resonance effects just cannot occur. These are not relevant to biology and cannot occur inside of cells. You said bees are attracted to these things. I would love to see the study saying bees are attracted to radio transmitters. Bees are actually attracted to flowers. It's true they don't walk on sidewalks. Transmitters are built where people live, not bees. That means they are even more removed, not closer.

Woods: I want to clarify your idea that the Bees are like rats and humans. We know if we test djoxin/aspirin today, rats get cancer but people do not. Can you please clarify what you mean that they are the same? That seems to break down there.

Swanson: This is a good point. You have to be careful about comparison and I was talking about the cellular level.

Woods: But chemicals are processed at the cellular level.

Swanson: If you are feeding aspirin to a rat vs to a human and if they normalize for the size, I would expect the response of test subjects to be very similar. But it's not what we are talking about here. Chemical reaction is far more energetic than reactions that are relevant to cellphones. Chemicals are like taking a hammer versus a gently tweaking it, like a cellphone does.

Chamberlin: On the previous slide, you mention exposure in some cases provides positive therapy. You are saying that it can't be both helpful and harmful. I disagree. For example, sunshine is a form of radiation. It is both beneficial like Vitamin D, etc. and harmful like skin cancer, depending upon exposure. I disagree with the premise stated there.

Swanson: You are right. There is room for something like this to happen. Like I said, I don't find this plausible and I have a reason why I don't find it plausible but I will get to that.

Abrami: On your electric towers slide, you said were definitive studies disproving health effects . We are trying to get at is, are there definitive studies RF in general whether it's 3G, 4G or 5G. Right now I don't know of any definitive studies saying whether 5G is good or bad. As a legislative body, we are trying to understand. We are blessed with having people in the room who understand these things. We have to be responsible to our public. If a small cell tower appears in front of their house, they will want to know, where is the definitive study showing its safe?

Swanson: Valid question. But those studies were specific to those towers. I completely respect that as a question.

Electromagnetic Basics:

- Electromagnetic radiation is the best understood phenomenon in the universe.
- It is not nuclear radiation.
- It is completely described by three numbers (intensity, frequency, and polarization) which makes it so well understood and so simple.
- Electromagnetic spectrum is a continuum from zero to infinity.

Ricciardi: Are you saying that you do not believe a potential mechanism exists for non-ionizing radiation to harm us?

Swanson: I will get to that in a minute. Do you mind?

Abrami: Let him cover non ionizing radiation and then ask your question.

Health Effects:

- You are well aware that there are health effects on this spectrum.
- UV radiation is dangerous. It's not good to get too many x rays. There are two scanners at the airport and you should go through the mm wave scanner not the x ray scanner because x rays are dangerous if you expose yourself to too many.
- Gamma rays are very dangerous. They will outright kill you.

- Ionizing radiation is damaging because of how it damages things. Your body responds by producing more melanin. DNA regulates reproduction of cells. You could mess with the reproduction of your cell and you get cancer. You don't want to damage your DNA.
- Shorter wavelength waves carry more energy.
- Visible light is just below UV light. Threshold effect between UV light and visible light. We can be in visible light all day and never get cancer because visible light is lower in energy. It is only a bit lower. There is no gradual tailing off. There is a threshold. This threshold effect between UV light and visible light was explained by Einstein in 1905. He won the Nobel Prize for this. That's called non ionizing radiation.
- There is a threshold 1.77ev and 2.25ev or minimal energy needed.
- The important thing: is that there is a photo electric effect.
- You need ionizing energy to remove an electron off its atom.
- When we talk about non ionizing radiation, there is no cumulative effect and there is no intensity effect and no effect on cancer.
- Ionizing is above the threshold effect. Non- ionizing is below on the spectrum.
- It doesn't matter how far below the threshold. Something could be just below threshold or far below threshold. It doesn't matter. The threshold is only thing that matters.
- Non Ionizing radiation has no known effect on the human body other than heat.
- Heat is just heat and motion of molecules.

Abrami: I understand water vibrates to heat in microwave but you wouldn't put your head in a microwave would you?

Swanson: I actually intend to put my head in a microwave next week.

Abrami: You are pulling my leg now, right?

Swanson: no. I am not going to have it at full power and will probably put my hand in. My point is, it's regular heating and what I will feel is my hand getting warm and then I will take it out. It's just like putting your hand on a radiator.

Wells: If radio frequencies that are non-ionizing have no effect, can you explain how radios work?

Swanson: they have no known health effects on tissue except for heating. EMR is absorbed by your skin. About half of it is reflected by the body. Metals are special because the electrons are mobile. Our electrons are attached to a molecule. They are hard to move except the salty water part of the cell. The signal in the radio just turns into heat.

Ricciardi: Thank you for explaining that. Before I ask my question, I want to understand what you said. It sounds like what you were saying is due to oxidative stress not heating. Did I understand that correctly?

Swanson: No. I didn't say any of those things.

Ricciardi: Well then. Are you saying there is no real potential harm for non-ionizing radiation?

Swanson: To the degree that you don't cook yourself, yes.

Ricciardi: There are several studies and if you can debunk them. I have a copy for you.

Abrami: Dr Swanson, can you address these later for time sake during your section on studies?

Swanson: Yes. I will address generic, not these particular studies later.

Chamberlin: I just want to say it's quite a statement and in preparation for service on this commission, I did a lot of work reading published peer reviewed journals and a lot of them DO say there are biological effects. So I am assuming you will address those.

FCC Regulations:

- I want to clarify misconceptions about the FCC.
- The FCC does not conduct experiments. It sets regulatory limits based on the evaluation of relevant literature made by many nation and international agencies.
- One of these agencies is: IEEE which has a rigorous policy creation process.
- I was very impressed with their methodology for how they come to their decisions.
- They are very thorough. They have various working groups where reports go into a committee called sub- committee four.
- Sub-committee four has 125 members in it. They have a broad swath of expertise.
- They looked at 2,200 papers.
- 5G is just part of the spectrum. It's the 30Ghz part of the spectrum. 5G is new. The physics and biology of 5G is not.
- You don't have to do studies at 5Ghz. Where do you draw the line? The difference between 4G and 5G is essentially meaningless when it comes to the response of humans to this radiation.
- FCC has two primary measures: Thermal behavior. IEEE determines thresholds of watts/kg.
- FCC sets its limit 50x lower than the limit detected on animal studies. Based on that they get the SAR (Specific Absorption Rate which should be less than 1.6w/kg) That is an extremely conservative number. I mentioned a heating pad earlier that is roughly 100w/kg.
- Another method is the MPE (maximum permissible exposure) Effects on humans start at 100x higher than the limit.
- Why are there two standards? BC at higher frequencies like 5G that does not penetrate as far in the body so it's hard to measure so they use MPE.
- 5G is called small cell because they are low power and closer together and about 30 feet high.
- Your exposure is about .4% of the extremely conservative limit if you stand at the base.
- It occurred to me that light is EMR and what would happen if the FCC regulated light? Or the sun? They don't for obvious reasons. We can see light. They expect us to react responsibly.
- For a 100W light bulb six feet away, you are at a quarter of the FCC allowable limit in terms of thermal exposure. Three feet away, you are at the FCC limit.
- If you stand outside in the sun, you are at 1600% of the FCC standard for exposure limit.

- The sun would be outlawed if the FCC regulated it.
- Should we worry about standing under a 5G tower? I would say no.
- Another example is the brain. It is a radio transmitter transmitting at the thermal end of the spectrum far higher in energy than 5G. Your body is 85W machine. The brain is 15W. It uses a lot of energy. The brain weighs about 1 kg. So I estimate an SAR of 15w/kg. So thinking would also be outlawed by the FCC whose limit is 1.6w/kg.
- Let's get to what it does to you. It heats the skin up. The higher the frequency, the less it penetrates the skin and 5G is at the very surface.
- 10W/m² is the FCC limit. Temperature rise at the surface of the skin. According to this model (The Human Body and MM Wave Wireless Communication Systems accepted 2015 IEEE International Conference) which shows a rise in temperature for different energy densities. The SAR limit of 10W/m² results in about .1 degree temperature rise.
- You would have to climb the 5g pole and hug and wait for your skin to rise .1 degrees.
- It would create more heat just in the energy to climb the pole. It's not magical stuff. It's just heat energy.
- Stepping outside or drinking a cup of coffee, you get a larger rise in temperature than irresponsible behavior of climbing and hugging a 5G pole.

Cooley: When you showed the heights of the various towers and small cells, because there will be 5G on towers as well. Can you speak to the difference of towers at 100-200 ft vs the small cells at 20-50 ft. Can you talk about the exposure based on the higher it is, the exposure decreases? I am making an assumption. If you use an average 150ft tower vs a 40ft small cell.

Swanson: If you are asking what would happen if the tower was 40ft instead of 20, then all of those numbers would go down. If you double the height, you go down by a factor of 4 if you are standing right under it. It's not that clean cut. With a higher tower, you have more powerful equipment. It's the same thing with 5G. If it's a 40ft tower, there will be more powerful equipment on that small cell. You have to take that into account. I am speculating that when engineers design the towers, they figure how to get down to 1/1000th of the FCC limit. According to research I just read, there are countries that measured levels at 1/1000th of the FCC limit. It wouldn't surprise me if it ends up being a wash if you double the height.

Cooley: Please clarify a term you used, lens opacity. What is that?

Swanson: It's the beginnings of cataracts.

Roberge: When was the FCC limit set?

Swanson: This is an ongoing thing. I can partially answer this. I know that the IEEE did this in 1996 and did it again in 2005. I believe the FCC monitors these new standards as they come out. But I don't know that they had an official meeting to incorporate all of that. I believe there is something in the news about reinstating a meeting.

Abrami: Yes. We have a paper on this.

Swanson: I believe you know more than I do about this.

Roberge: When they set this, they were only looking at heat effects on the body. Do you know when they look at this again and will that include other biological effects?

Swanson: I wouldn't quite put it that way. They looked at 2,200 papers. They don't just go, oh this one deals with other effects and throw it into the garbage. They take all of it into account. Of course, the things that you focus on are thermal effects because those are easily measurable. Other effects are random.

Heroux: You describe the review process of the IEEE in glowing terms.

Swanson: Yes. It was glowing. I was very impressed.

Heroux: Were you there?

Swanson: Was I there? No.

Heroux: Are you a member of SC3 or SC4?

Swanson: No.

Heroux: You don't go to IEEE meetings?

Swanson: Nope

Heroux: So in other words, your description of this review process is based on what you were told.

Swanson: That's correct and from what I read. Yes.

Heroux: Ok. I was there. I can tell you that this process is far from impartial. I have personal experienced it and if you want, I can tell you how it happened. At the time, I had designed an instrument that measured pulsed EMF. I was part of an epidemiological study at McGill. It was found that all the underground workers exposed to these fields and smoked, systematically died of lung cancer. ...All of them. This was done by Armstrong a biostatistician who is now in London. I was charged with informing IEEE of this. I was a member of SC4. I went when Eleanor Adair was presiding and I unfolded what had happened. Eleanor Adair said we will form a committee and we will look at this. There was a separate meeting. They wanted three members to join the president to study this. I was the one who designed the instrument and the only one at the time who knew of the epidemiological study determining this. At that meeting when they asked for volunteers, I raised my hand. Since only two other people did, I thought I am going to be able to discuss this openly in an IEEE committee. I was never called. This reflects the fact that your selection of the people controlling these committees and the literature that you review is very partial. It's not for some conspiracy but because of the fact that there is a natural tendency to assemble similar opinions in a given location. Are you aware that Eleanor Adair, who was president of SC4 for years and yea, at the time that she was supposed to be a judge on whether non

thermal effects occur, simultaneously published a paper in the open literature promoting the idea that we should heat the people rather than houses.

Abrami: Dr. Heroux, is there a question you want to ask?

Heroux: Yes. The review process is very difficult to control and hard to be impartial. I have lived through these difficulties. When you haven't lived through the process, it's very difficult isn't it? to be entirely certain that it's entirely impartial? Would you agree?

Swanson: That is way too generic for me to agree.

Abrami: We are hoping to hear from IEEE, so we can form our opinion on that.

Swanson: Personally, if I formed a subcommittee I would not want one of the paper's authors on the subcommittee. It would be biased.

Wells: can you give us an idea of the wattage of a 5G transmitter and handset?

Swanson: The handsets will be similar to current handsets that operate around a watt. The 5G transmitters are much smaller than 4G. I ask this question many times and I always get the run around. The reason is because different sites and different manufacturers have different specs. Roughly speaking, it's 10-20 watts for the transmitter.

Wells: The function of 5G is communications so how would you relate data rate to intensity and frequency?

Swanson: Those are good questions. One of the major goals of 5G is to increase data rates. Apparently, everyone wants to watch their videos on their cellphones. That's why this higher frequency is needed. The reason these need to be closer together is higher frequencies have trouble penetrating wet air. The more humid it is, the harder it is to penetrate. So they tend to be closer together, low power, high frequency.

Wells: The power density in w/ square meter. Is that a parameter that affects data rate?

Swanson: Yes. Actually it is. The stronger the signal, the more data you can push through. Dr. Chamberlin can probably address this better.

Chamberlin: I wanted to get clarification on the setting of limits. You mention two ways. One is the IEEE going through publications to find out what other people have established as safe limits. You also mention there was an animal study where you expose some sort of animal to increasing amounts of radiation until you saw a change in their behavior. Then, you use a factor of 50 below. Which is it? Do they use both together?

Swanson: I didn't see a conflict there. Part of what IEEE is doing is looking at animal studies. That's one of the things they look at. That's what the IARC looked at as well, animal studies. So they are looking for any effect.

Abrami: But, isn't it just thermal effects they are looking at?

Swanson: No. they look at everything under the sun. These guys review what scientists look at and the only thing that actually sees something definitive is the thermal effects.

Chamberlin: But these are short term studies and that's my concern.

Swanson: They vary.

Swanson: I touched on it before and I will talk about this again on a famous NTP study later.

Ricciardi: I just wanted to clarify something on the FCC. I have a couple of documents stamped from the federal government in 1985. A letter written from the EPA to the FCC and it says they have done the studies on the heating of tissues and explained to the FCC that they needed to do studies on non thermal effects because it can heat chronically low over time. Heating of tissues vs non heating of tissues and only heating was studied when the EPA wanted to go further. The FCC responded by saying they were taking this out of the hands of the EPA and putting it into the FCC's hands. So we no longer have a health agency representing us doing those studies. The FCC is not a health agency.

Swanson: That's right. They are not. They have a committee and listen to what they tell them. They know what they are talking about.

Ricciardi: I think these scientists that have done peer reviewed studies know what they are talking about. How many peer reviewed studies have you done?

Abrami: we are going to get to the next topic.

Studies:

-Everything I have been telling you is consensus, mainstream science.

-There is no fringe aspect, controversy or conspiracy theories.

-In the internet age, it is possible to find a "respectable" source that says anything, from silly to ludicrous to dangerous. There is the flat earth society, pizzagate, and we all know of black helicopters coming in the night to take us all away. It is important to search out consensus views.

-Statements from National Bodies: FCC, FDA, Cancer Institute, Cancer Society (see slide)

-Statements from International Bodies: European Commission, WHO, Health Canada, UK Health Protection Agency, Swedish Council for Working Life and Social Research, Norwegian Institute for Public Health, Australian Radiation Protection and Nuclear Safety. (see slide)

- The Swedes and Norwegians say this is safe. They are most sensible people in the world.

-Here is the upshot. The rate of glioma, which is a rare brain tumor, has gone down in the US. The rate of cellphone use has increased. There is no correlation at all. That is a very powerful statement.

-There is a difference between doing physics and chemical studies and health and nutritional studies. Health studies are very difficult to do and have them be reliable. There are conflicting claims. I can't tell you how many times I have heard eggs are good for you, then they are bad for you then they are good for you. I don't want to give you the idea that science is useless or these people are dumb. Neither of these is true. It's just difficult to do studies on humans. Humans are not great subjects.

- Amgen tried to reproduce 53 landmark studies on cancer. They were only able to reproduce six of them. Bayer Health was only able to reproduce 25% of 67 studies. It's just really difficult to do this stuff.

- Most cited paper of all time in medicine: Dr. John Ioannidis studying studies. He found that 80% of non-randomized studies turn out to be wrong. There are many reasons for this: study biases (to make splashy result), lack of blinding, difficulty working with human or animal subjects, the rarity of effects being sought (trying to tease up very subtle stuff), the expense of dealing with many test subjects.

Example: NTP study

- One important aspect is the problem of Multiple Comparisons:

- For example, I am going to examine a lot of outcomes from smoking. I have to conduct my experiment at a certain level of acuity. That's called a P-value. Industry standard for P-value is 5%. The P-value is the probability of observing the effect seen, or greater, given that the null hypothesis is true. Let's say you decide that cigarette smoke is not dangerous. That is the null hypothesis. Then you find your rats are getting lung cancer. Then you would say the probability of rats not getting lung cancer is very low. That implies that you are seeing something. I am going to assume a much tougher standard in my experiment with a P-value of 1%. That means that if I have 100 subjects, one of them has to have the outcome.

What happens in the real world with P-values much higher than 1% is that you could have three studies and they all have outcomes. You could have several different outcomes, not just the one you are testing. What is then reported, are all of the outcomes when in fact it should be none. For example...news clip about powerlines causing brain cancer, leukemia, breast cancer, birth defects, reproductive problems, fatigue, depression, and many others. It's implausible that a single thing causes many things.

- A single exposure causing many outcomes is a sure sign of the multiple comparisons problem! All of these studies find different things. If they don't start replicating each other, you shouldn't pay attention to them.

NTP Study-the claim:

- There is clear evidence that RFR causes heart tumors in male rats
- There is some evidence that RFR causes brain tumors in male rats
- There are problems with the NTP Study: (see slides for detail)
- The problem with the NTP study is the Multiple Comparison Effects.

Heroux theory:

He claims that electric fields from cellphones disrupt proton transfer in water, thereby “influencing the properties of water and the stability of DNA”

- This is a valid scientific question. We should delve into it.
- So what is going on here is something called the acid-base reaction which creates H_3O molecules. There is about 1 H_3O molecule per 10 million H_2O molecules. The extra proton can hop along chains of water molecules. This is called the Grotthuss mechanism. This is normal and is a chemical reaction. What is the effect of an electric field on chemical reactions?
- There is a study by Boxer at Stanford using fields from 2,000,000 V/cm to 100,000,000 V/cm to see a reaction. Cellphones max out at 1V/cm!
- So the physics of it and the chemistry of it say its fine but the magnitude of it says it's not something to worry about. A cellphone is not sufficient to cause any chemical reactions.
-

Chamberlin Presentation: I need to correct or point out what he said.

Chamberlin claim: power per unit area becomes alarmingly large.

- Significance of $1/r^2$ Power relationship. The implication that having a cellphone in your sports bra (per slide) is definitely not a good idea, I have a problem with. This is misleading.
- There is something called the Fraunhofer distance. The near field and the far field have different laws.
- You need to compare to IEEE localized MPE at 30 Ghz. It's well below that.
- I have to say this is not what is actually going to happen. What is actually going to happen is very complicated. You have to simulate these on computers.

Abrami: We are running out of time. We need time for questions and responses from Dr. Heroux and Dr. Chamberlin on your remarks. We may take you up on your offer to dial in at a future date. You mentioned the WHO but the WHO categorized RF as a group 2B carcinogen. Can you tell me how that works? You said the WHO said there is no problem but they have graded it like lead and thalidomide.

Swanson: Sure I can address. First a technical point. The reason there seem to be these conflicting statements is it is actually the IARC which is a sub portion of the WHO that made that statement.

Abrami: There are many articles saying WHO.

Swanson: Just because they ascribe it to WHO, it's really IARC a sub portion. They do categorize it like lead like you said but also things like coffee, sawdust are in that group.

Abrami: Ok . You made your point on that.

Swanson: This committee (IARC) like IEEE only smaller looked at literature and concluded Group 2B. The standard for that is a very low bar. They made this on two things. The first is a data point on the interphone study in Europe and a collection of studies from Swedish researcher Hardell. The other

studies find no effect. I actually wrote to them and asked them, what are you doing??? What they said was, we are applying the Precautionary Principle.

Abrami: Dr. Sherman would bring that up, the Precautionary Principle.

Swanson: I have written about this. I am fine with the principle. But you can go overboard. It would be prudent not to go outside, not to get on a plane but I do it and accept the risks associated. One thing about the data points on the phone study. They self-reported that the numbers are unreliable.

Abrami: So why then is there a legal notice on RF in your cellphone telling you to keep it away from your body?

Swanson: It's not science. It's precautionary with a flavoring of legalese is what that is.

Abrami: So you are saying there is no science behind that legal notice?

Swanson: Correct. Yes.

Abrami: Let's talk about insurance industry. They recognize wireless radiation as a leading risk and place exclusions not to cover it. What does the insurance industry know that we don't know?

Swanson: I am not qualified. I don't work in industry and don't talk to them.

Heroux: You make a great point of giving a lot of influence to the concept of ionization vs non ionization. So if I take a copper atom in space and I want to extract an electron from it, it will take me a fair amount of energy. Is that right?

Swanson: Yes.

Heroux: We call this the extraction energy from the atom. But if I take a group of copper atoms together, how much field do I need to move the electrons in them?

Swanson: You don't need much. It's easy.

Heroux: It's called the degenerate fermi gas. The fact that you bring these atoms together changes considerably the electrical properties of the material. So you agree with me that if you have a material that has closely packed atoms and the electrons or protons move through the material then a small electric field can influence the motion of charges.

Swanson: Yes. But so we are not confused. We are talking about metal and of course people are not metal. There is an analogous effect on people though that I rarely ever mention where cooperative effects can cause something below the ionization. However, it's extremely rare and I don't feel like I was lying to you.

Chamberlin: I feel epidemiology is going to play an important part in the decisions of this commission. Your slide on gliomas vs cellphone usage is pretty convincing and that may not be the issue. But something that does concern me in the same time frame (1989-2005) is a 32% decline in male sperm

count. That is major and significant. If you look at the studies that have been done, they are pretty convincing even exposing people at low levels below .1W/kg. They are getting statistically significant effects. I am not talking about P-values of .05 but of .001. I am wondering if you are aware of these and it correlates very strongly to wireless networks and cellphones.

Swanson: There are a lot of studies who are going to see an effect and some are going to be statistically significant. The real question is, are they reproducible? I don't look through all of these but every time I do look at one, I see problems and I don't see reproduction every single time. It's just amazing. I thought the NTP study...wow, this is a going to be a good study. Oh my god...they had problems. This always happens. The existence of these studies doesn't surprise me and would concern me if they could be reproduced but they can't. So I have to look at the consensus.

Chamberlin: There were 16 studies where statistics looked good and they all say the same thing. It's global epidemiology 32% sperm count decrease.

Swanson: Let me address sperm count. I use this in my class. There is a problem with studies. They are not based on same criteria or same subjects. About four years ago, the Danish Army did a study and they completely debunked this. There was no effect.

Wells: The Boxer lab slide is that a static field not an RF?

Swanson: Yes. I believe it's a static field.

Ricciardi: You just made a comment that you don't buy into these studies because they aren't reproduced. Many of these have been including the NTP study which was reproduced twice. What peer reviewed studies have you done?

Swanson: I have not done animal studies. I do theoretical studies.

Ricciardi: I find it difficult that you can dismiss all these studies showing biological health effects from cellphone radiation. The international EMF scientist appeal. That's 2,000 reproduced papers of studies over and over again with 240 scientists studying the fields on biology and health. How do you argue that health and regulatory agencies state that there is a scientific consensus that cellphones are safe when so many experts disagree?

Swanson: That's a good question. This thing is called the 5G appeal. These are scientists and doctors in Europe and North America saying let's slow down on 5G. So how many scientists and doctors are there in Europe and North America? They have 260 people out of 26,000,000 that have signed. That's not consensus.

Ricciardi: You misunderstood me. I wasn't talking about a petition. I was talking about 260 scientists doing studies.

Abrami: I think he stated his position already. We are short on time. If you could spend some time later on the phone or webex maybe in a few months. We may have more questions for you and you can finish. (He ended his presentation just before Nasim and Kim).

Next meeting: Friday, December 13th . 8:30 was agreed upon. We will have one speaker and then talk through where we want to go next.

V. Meeting Adjourned at 10:35 am.

**NH COMMISSION TO STUDY THE ENVIRONMENTAL AND HEALTH EFFECTS
OF EVOLVING 5G TECHNOLOGY**

Meeting held:

12/13/19

8:30-10:35am

LOB 202

Meeting called to order by Rep Abrami at 8:30 am.

In attendance: (10)

Rep. Patrick Abrami-speaker of the house appointee

Rep. Ken Wells- speaker of the house appointee

Kent Chamberlin-UNH-appointed by the chancellor

Denise Ricciardi-public-appointed by the governor

Michele Roberge-DHHS- Commissioner of DHHS appointee

Dr. Paul Heroux- Professor of Toxicology, McGill University- speaker of the house appointee

Rep. Gary Woods-speaker of the house appointee

Senator Jim Gray-president of the senate appointee

Carol Miller-NH Business & Economic Affairs Dept.

Senator Tom Sherman-president of the senate appointee

Not present: (4)

Frank MacMillan, Jr. MD-NH Medical Society Environmental Medicine

David Juvet-Business and Industry Association

Bethanne Cooley-CTIA , trade association for wireless industry and manufacturers

Brandon Garod-AG designee, Asst. AG Consumer Protection

Agenda:

I. Approval of minutes from 11-21-19:

Minutes were approved.

II. General Discussion:

Abrami: Recommendations will be based on general consensus.

Minority reports can be written by anyone if there is disagreement.

Focus: things that we can do as a state: from as simple as warnings...to ordinances.

There are things going on in our state right now. Dr. Sherman and I are cosponsors in smart meter bill allowing opt out without having to pay a fee to do so.

- A. The electromagnetic spectrum discussion on terms such as: frequency, wave length, photon, electron volts, etc. and comparison from radio to Gamma. Frequency is the inverse of wave length.
- B. Energy. Radio waves are the lowest electron volts. Gamma Rays are highest at 1.24MeV. Where is the break point? None of this is linear. Science says ionizing radiation which expels electrons from atoms or molecules, doesn't happen until UV rays. However, we have learned that it's actually doing damage below that. The question is: Is the science still out on damage beyond "heat", which is the FCC's standard? It seemed from one presentation that they looked at papers beyond heat so we still want the FCC to talk with us. I will see what we can do.

Sherman: We may be able to inspire them with a nudge from one of our Senators. I would be happy to do that.

Abrami: Kent, I took this from your presentation!

B. Photons: EMR can be represented by discrete packets of energy called Photons.

1. Increasing transmission power will increase the number of photons (although the energy in each photon remains constant).
2. The energy in each photon is proportional to the frequency of the transmission.
3. If the photon energy is great enough to detach electrons from atoms and molecules, it is referred to as ionizing radiation.
4. All the charts that I look at say that happens at UV level.

Wells: When you are ionizing radiation and you remove an electron, you are breaking a chemical bond but you can break a chemical bond at much lower energies. That's why we can see. This is also why humans can photo-synthesize vitamin D. They do it at energies much lower than UV.

Woods: Along those lines, we have to remember, and this is important. This is isolated episodes. However, biological systems work collectively. They diffuse their base energy around parts of a molecule. There is thermal activity already and sometimes can cause a disruption of a bond without anything occurring from anything external. We have to remember that these are terms that we are learning but they are for isolated singular entities. Some electrons are shared by biological systems and are a very different process. We have to go from a single item to a collective and that's a big jump. These are some of the experiments that Dr. Heroux is working with that tries to address that biologic collective entity.

Sherman: One factor.....Transmission power: If I remember correctly, people in industry were saying that each tower would be lower in power because there would be so many, is that correct? My question is: if you increase power, there are more photons but the energy in the photon is proportional to the frequency. So when you increase frequency to 5G but decrease transmission

power, you will have fewer photons but they will each be higher energy. What does that mean to us on the receiving end?

Wells: And the antenna is closer. As 5G single transmitter power density goes down but the number of them is much larger and they are much closer. It's like little Christmas tree lights around the room instead of just one bright one.

Sherman: Does that mean that the total amount of exposure will go up?

Wells: Yes.

Sherman: Because of the proximity of the antenna?

Wells: Yes.

Sherman: even though the power is down?

Wells: Yes.

Sherman: The photons will have more potency and you are closer to them.

Wells: They will have larger numbers. The total power of a 5G system has five orders of magnitude which is 100,000 times more intense than a 4G system!

Abrami: This is something we have to focus on. Kent, do you have something to add to that?

Chamberlin: No. I agree with what's being said.

Heroux: Basically with the beam forming you tend increase the directionality. It's more focused. With the old systems, they broadcast to a very wide area. So it's true that the new system 5G will be less power input into the antenna. But the beams will be much more focused and the cellphone will also have the ability. You are talking about very narrow beams that will be directed to you when you use the system so that means increased levels of radiation because of this concentration. The antenna is spending less power because it is not broadcasting everywhere.

Sherman: You just said something that I don't think I put this together until now. When the cellphone is 5G capable, is the antenna putting out the same level of radiation?

Heroux: It's going to put out the same type of radiation. They are miniaturized antenna in a chip that is implanted inside the phone which you will hold so you will direct the beam to wherever it wants. You will have a more concentrated energy coming from your phone. The radiation pattern will be fundamentally different.

Sherman: So will it be 5G level radiation be coming out of your phone?

Heroux: Yes.

Abrami: Ken wants to talk about antennas after we get through this.

- C. Specific Absorption Rate: power absorbed by mass of tissue=energy is absorbed by the human body when exposed to RF/EM field=Watts/kilogram. US cell phone standard is: 1.6Watts/kilogram or less.
- D. IEEE/ICNIRP 209 standards are still the same basically what the FCC uses.

Dr. Swanson said that the FCC reviews biological standards as well, not just heat. We really need to speak with FCC on this.

Chamberlin: I thought my question to Dr. Swanson was pretty direct. I asked him which of the two approaches setting standards, did they use. One he described was on animal studies exposed to increasing radiation until their behavior changed, divide that by fifty and you come up with a standard. That was one way. He also said they relied on publications written but he didn't say which did they use? He said both but I don't feel like I got my question answered. If it's the behavior in animals, then that is a short term phenomena and does not address the concerns that we are looking at in this commission where people are going to be bathed in electromagnetic radiation 24x7. I am really unhappy with where we are, with finding out that piece of information.

Abrami: Dr. Heroux, I know you went back and forth with him on this and you were involved.

Heroux: Yes. The FCC cannot try to implement a national standard for radiation without claiming it is taking everything into account. Yet, they don't have biologists on their staff. They have a tradition of being a spectrum allocating agency which is very important for coordination in the country but they are not biologists. A better body to ask is the IEEE. Again, the IEEE is heavily influenced by engineering tradition and I would reinforce the argument of Dr. Woods. All of these things about physics are entirely true and entirely valid. What what we cannot forget are that biological systems, the fact that we think and we act are processes. These processes involve manipulations of electrical charges in our body. These processes fundamentally move electricity around in our body. Those are unstable processes that can be influenced by vanishingly small amounts of energy. Energy is an immensely valuable concept. But the complexities of biology have been underestimated by engineers eager to serve the public with applications and by the FCC eager to serve commerce.

Roberge: I asked Dr. Swanson a question related to the FCC standard as well. I thought I remembered a conversation about the standard being focused strictly on heating rather than other biological effects. That was my question with him, to understand are they strictly looking at effects of heat or are they looking at other biological effects? I am not clear on his answer. I am not clear if the standard evaluated other studies or just heat. I also thought it has been awhile since they set the standard.

Chamberlin: I would like to interpret what I heard him say. As long as you are below UV Ionizing radiation, the only factor is heating. There is a question about how much heating you can tolerate. That has been the industry mantra on radiation exposure for as long as I have been in the field. I believe that is what they are using as the criteria.

Abrami: That standard hasn't changed much over time, is my understanding.

Sherman: I apologize. I could not be here for that meeting. We are talking about human health effects. This bathing 24x7 is not just on the human environment. It's on the entire environment. Do any of you know if there are any studies on plants or animals and others exposed to this?

Chamberlin: Yes. There is a study that shows that tree and plant health near cell towers is degraded considerably. I have a paper that says that.

Ricciardi: There are many studies and a big study on the damage to bees. I did ask Dr. Swanson because he dismissed the fact that it harms bees. So I handed him the study. It has a huge impact on the environment.

Abrami: Let's pause on that one. There was a study done on bees using twelve hives. Half of the hives, they put cellphones in and in all six, they did not come back to the hive. They got confused and you wonder ...why is that? It must have to do with their navigational system. I always thought they had sensors that pick up the Earth's magnetic field. All of a sudden we are going to cloud the Earth's natural magnetic field with man-made different frequencies.

Ricciardi: This one is the exposure of insects to radiofrequency electromagnetic fields from (2-120Ghz), published in Scientific Reports which is the first study to investigate into how insects including the Western Honey bee absorb the higher frequencies to be used in 4 and 5G. The simulation showed increases in absorbed power from 3% to 370% when insects were exposed. This could lead to changes in insect's behavior, physiology and morphology, over time. I did ask Dr. Swanson, can you confirm that these frequencies are safe for pollinators and what credentials he had to speak to this? I don't feel my question was answered at all.

Abrami: This is one I feel we need to follow up on. I found studies on bees at low levels that impacted the number of queen bees produced by 40% something like that, which is significant. Bees are our health, food, etc. It's navigation, which can also be biological. I don't want any of us to sound like alarmists. We want the facts to come out and we want to understand this. But on my list, I think bees and probably migrating birds as well are important.

Wells: there has been a lot of work on homing pigeons, migrating birds and bees. They also use iron to determine which orientation the EM field is. The effect is if you hit the frequency that will make that move, you will make that sense blurry or obliterate the usefulness. There haven't been a lot of studies determining what those frequencies are. However, if you confound the major pollinators, that puts all of plant life in jeopardy.

Abrami: yes...that's oxygen and food.

Woods: It's important for us to ferret out in these studies which include 5G because our charge is 5G. We know that that the photon energy is different. The comment that I heard him say was, how many G's do you need to study? We need to study 5G. As we go through this, we need to make sure studies include 5G. The energy is definitely different and we talked about that. Some of the studies do not include 5G.

Ricciardi: There is a recent study this year on 5G in France and Netherlands. They measured the RF from small cells increased radio emissions from the base stations while decreasing the radio emission from the user. They found that in the area human sickness is well documented and has increased since it's been installed. This is all involuntary exposure hanging in front of people's homes. With your phones, you have the choice to turn off or not own. I have issues about choice and it's a privacy thing, too.

Abrami: The 1/R² rule. Meaning the further away you are is a physics principle we need to talk about too.

Issues:

- Biological effects of non-ionizing radiation.
- We need to make sure these studies are not flawed.
- We need to find studies that are replicated.
- We need to understand the FCC approach to standard setting. Are biological effects included or not?
- Impact on navigation of bees, birds and other living things such as interference with Earth's magnetic field used for guidance (non-biological).
- Energy level from cell towers and small cells based upon distance. What other factors?
- Legislative activity, ordinances and the courts around the country and the world.
- RF Communication security. It's scary what's going on in China. Facial recognition, etc. Pretty soon you won't need any devices.
- Insurance Issues: why is it insurance companies won't insure this stuff?
- Smart meters on homes.
- Precautionary Principle. Dr. Sherman, I know you think this should apply here.
- Final report will have recommendations for future legislation or public health warnings based upon solid facts. We will come to a consensus. Anybody can write a minority report on any part they disagree with.

Sherman: One thing to consider is looking at all this frequency and power. Are we already beyond the safe level? Is 4G not safe? Is what's out there now unsafe even before 5G?

Abrami: well, we are not going to take people's cell phones. That's not going to happen. To industry, it means money. There are not definitive studies on 5G that there are not health effects. I asked Swanson that. Where are the studies that say 5G is going to be safe? Show us the definitive studies.

Ricciardi: I asked him, are you saying that 4 and 5G are not harmful? He said yes. To Dr. Sherman's comment about already being dangerous, your cell phones already have warnings buried in your phone to not put them close to your head or ear. People really don't know that. It is dangerous. We aren't going to get rid of phones. One solution we may want to consider a right to know law at the point of sale because people will still buy them but they may use them more carefully, just like cigarettes are still sold with a warning.

Sherman: That's my point. If this commission finds out that maybe we have crossed that threshold into what may be dangerous, I think transparency in sharing that knowledge is important. Also with 5G, one of the concerns is everyone will be exposed whether you own a phone or not. Are we already at that point with 4g whether you own a phone or not and is that exposure potentially toxic? That is something where we can at least raise the question.

Ricciardi: Very good.

Heroux: I have a number of comments. I have been in this business for a long time and I want to emphasize the importance of what has happening here and the influence that you are going to have. You are not the FCC. You are not the IEEE. You are not the Chinese government. But, you are a public body that has NO conflict of interest. You can claim that engineers have a conflict of interest because they are pushing products. You can claim that the FCC has a conflict of interest. This body apparently has none. It is looking at data and reality. The discussions that we are having today are incredibly rare. They are usually held in private between individuals. Although New Hampshire has limited power implementing laws and regulation, what you will recommend, will be heard. That can have tremendous influence on the future. I see that responsibility on the shoulders of this committee, as huge.... planet wide, in my opinion. First point!

The frequency range of 5G can be very wide because industry is very flexible in what it does. Some frequencies used in 5G are lower than some used in current systems. Some that have been allocated are much higher. As Tom Wheeler would say, if someone tells you that they know what 5G is, run the other way because not even industry, itself knows. So, we are forced to evaluate electromagnetic radiation as a whole.

About scientific studies: All scientific studies are flawed. You would have to have unlimited money and time to produce one that is not. The weakness of the overall process is that because you can criticize ANY study, a committee that has a philosophy, can get rid of studies it doesn't like. This is a reality that is inescapable. The philosophical attitude of the people assessing science is absolutely tantamount.

Another problem is that the reproducibility of experiments that you are familiar with in engineering or in science is higher than what you have in biology. This is because biological objects are inherently extremely variable. So when you impose the same standards of reproducibility on biology to those of engineering or science, it's extremely unproductive, in my opinion.

The physicists have to bear the guilt of the atomic bomb. I am sorry to say this but electrical engineering will have to bear the responsibility of 5G. In a sense, it's electrical engineering's atomic bomb. Probably the people who can attenuate and manage this are here.

III.Ken Wells: Presentation on 5G malign applications:

Culture of Safety:

It has been said in this room, that little research has been published on the hazard or the safety of these frequencies. I have been involved in hobby auto racing as a driver, pit crew and safety corner worker. I am used to cooperative safety culture that asks, what is the worst thing that could happen? Then you work together to make sure that is very unlikely or impossible. I don't see that 5g is progressing that way. I think we would be wise to take that same approach with high frequency radio frequency.

Is it possible for radio frequency to cause harm?

There is an RF weapon that's called "active denial system: that uses 3.25mm or 95 Ghz band of 5G. In testing, it was able to create a burning sensation in the people it was aimed at in a tenth of a second. It was able to create 1st and 2nd degree burns in less than a second. In one case a subject was hospitalized for two days. So, yes RF radiation can cause harm. From this military experiment, we have evidence that RF can cause pain and injury. I would like to explore what could happen if instead of a cooperative safety culture that I spoke about, that a maligned player either foreign or domestic wanted to pursue a nefarious use of this RF against a civilian population. In theory, could a 5G network of small cells, IOT and devices be weaponized? I think so. This is the worst thing that can happen scenario that we must render impossible.

Physical descriptors of RF. There are three major ones are used universally.

1. Photonic Energy that you can categorize in terms of frequency or wavelength.
2. The intensity of radiation: The brightness if you will. It expresses how much energy strikes an area in a given time.
3. Duration of exposure. The IEEE standard 95.12019 is substantial and you should look in to that document. The research in that describes a quantity called fluence which describes field strength times the time you are exposed to it. It implies that pulses of RF should be separated by a few tens of seconds to avoid damage. That is not currently incorporated in the standard but something I think we need to pay attention to.

Absorption: waves transmit energy from place to place. EMR interaction with matter is frequency dependent. It has three ways it shows that dependency. The first one is heating. Second, is quantum effects with sharp bands particular frequencies that are strongly absorbed by particular atoms and molecules. That is not so well studied.

Third, you have anisotropic effects. Those are not uniform in all directions. Those include things like polarized emission and absorption, tunneling, and we don't really understand the biological role very well. We know they are very important. We know that we can point to these in chlorophyll and DNA.

Membrane bound biological processes like photosynthesis, oxidative phosphorylation (respiration), reproductive fertilization and neurological processes are all things where we think these electronic reactions are happening. There is even some theory by Roger Penrose and others doing research that the human brain might even enlist what is not well understood called quantum entanglement. There could be a role of chaos theory. As Dr. Herox said, very small electrical fields are involved in these biological effects.

On page three, I took measurements from a cell tower. I happened to be hiking and got some readings of a 4G Verizon tower. Dr. Swanson told us that the amount of power was hard to pin down. The manufacturer said it was only about ten or twenty watts. I am not sure what we should believe. Since there is so much variation on it, we need to be able to put a large error safety bar on these values. I am most concerned about the layout of these small cell antennas which resemble a phased array.

A phased array is the way that modern radar picks its direction. Remember that old ones had oscillating antennas. A phased array nothing moves but you change the characteristics of the antenna in order to steer the beam. The hardware layout for small cell 5g antenna areas meets the requirements for a phased array about a hundred meters apart over an entire city. Once this antenna is built, a maligned operator using software could upload to the array to alter its function from the benign communications function to a high powered steerable array either to disrupt communications or to actually be used like this military device. Foster et al say in IEEE 95.1 "The use of multiple steerable beams from 5G base stations will introduce new issues for compliance assessment for future RF exposure risk" which I think is quite an understatement.

I don't think that we or the FCC, can effectively regulate either operating frequencies or power levels of such an array because today's equipment hardware characteristics are completely transformed by software. You need only to consider the VW "Dieselgate" cheat to see how software can be used to hide or reveal deeply embedded nefarious capabilities of hardware. Since regulation of wave parameters can't be done with this array, the phased array deployment has to be blocked by controlling what kind of physical antenna can be built.

We could continue on our current path of allowing maligned foreign entities to sell us 5G equipment or even components that go inside these things. How hard would it be for a remote operator over the internet, to toggle the equipment from its benign communications into another role? This role may operate on another frequency for espionage and surveillance, or to increase the power as a weapon and deny us our Constitutional right for assembly. It would be easy if that maligned capability was built into the hardware that we purchase as a Trojan horse. There is once piece of good news in this. The atmosphere attenuates the signal fairly strongly.

There is a spectrum on the last page. In the mm band, there are really only a few windows. The military application picks the biggest of the three peaks between 1-10 mm at 3.75mm and those are also the same bands you want to use for communications. The Air Force began development of "Active Denial System" in 2000. It used 3.25mm (95Ghz) RF as a crowd-control device whose range was "greater than conventional small arms" (3km). In testing, it could cause "an instantaneous burning sensation" in .1 sec

exposure, along with first and second degree blistering burns on human subjects for exposures of less than 10 secs. One case required a two day hospitalization. It was tested as a 30MW mobile truck-mounted “area denial” system in Afghanistan in 2007. Could a malign player (foreign or domestic cyber-attacker) pursue a nefarious use of RFR against our civilian population? All of this suggests a couple of avenues we could consider.

Prevent the rollout of antenna array that can be used as a phased array. Transmitters should be built using MIL-SPEC US component suppliers, with the same degree of security and oversight used in other weapons systems. Do any citizens in the US ever worry about their constitutional rights, or oppression at the hands of their own government?

Abrami: We need to end here. We are going to have to follow up on your major points.

IV: Tim Schoechle PhD: National Institute for Science, Law and Public Policy presentation:

Schoechle: Computer and communications engineer for 45 years and on the faculty of the University of Colorado for a number of years prior. I’m speaking now for the National Institute of Science, Law and Public Policy think tank in Washington that writes on health and safety issues as well as telecommunications and energy issues.

The purpose of this paper is to give an overview of current technology and both the technology and the policy issues in telecommunication including internet, wired and wireless.

1934 the Telecom Act established the FCC which regulated broadcast radio and telephone service.

1986 The Bell Monopoly (AT&T) was broken up.

1996 Telecom Act revised the 1934 Act. Wired Communications were covered under Title II (common carrier), leaving the wireless and cable essentially unregulated.

1990-2010 Wireless rolled out 2nd and 3rd generation wireless.

What developed out of that was the reincarnation of the Bell Monopoly that began around 2000 which resulted in today’s duopoly of Verizon and AT&T. This is not the Bell AT&T.

A major point here is: the massive cost subsidization of wireless by diversion of fiber to serving cellular network. One notable point is Verizon’s abandonment of FIOS that it was marketing in 2000.

Abrami: You say there are two major players but what about T-Mobile?

Schoechle: Cable is the third player. It makes it more complicated because it’s a wired service and wireless. It’s really a trio-poly. The rest is much smaller.

Abrami: Talk about the flow of money and the diversion of subsidization. Are you talking about the charge on landlines that were supposed to be used for optical fiber infrastructure?

Schoechle: The “Book of Broken Promises” is a 600 page book that describes in detail how this diversion took place. The obligation was to upgrade wired infrastructure from the charges that ratepayer money for on the telephone bill. That money was charged against the wired and used for the wireless. It amounts to about 500 billion dollars. Basically, it made wireless look a lot more profitable than it would be otherwise.

The drivers: the need to sell more phones and now its 5G. It’s about selling equipment. There has been a slowing on the sale of cellphones. The industry philosophy is planned obsolescence.

The new subsidy is YOUR public rights of way. It’s a preemption of local property rights and rights of way that give telecom a grant by right to public property. Over twenty states have adopted legislation to take away the rights of localities which was inspired by if not written by the American Legislative Exchange Council (ALEC). It was written to take away control of states and localities of deciding on this equipment.

The FCC is a captured agency and presently chaired by a Verizon attorney, Chairman Agit Pai. It’s not surprising that it serves their purpose.

Surveillance Capitalism: There has been a transformation in the past twenty years that began in 2000 to a surveillance business model. This is really important if you want to understand the telecommunications industry and particularly the IT industry.

It has gone from selling products and services to the new model of trading in personal data. The tail is wagging the dog. The data is more important than what the equipment does. This was developed by Google and refined in 2010. It has been adopted by Facebook, Microsoft, Amazon and now Verizon, AT&T and the entire IT industry. There is a book called “The Age of Surveillance Capitalism” by Shoshanna Zuboff of Harvard University. She has written a monumental piece that details how this occurred and the social implications. You have to understand this to understand why information technology is going where it is today. It is selling data, selling behavior and advertising primarily. It is also selling behavior modification, which has political implications as we know. Selling control of people is where this is headed.

Wireless devices and networks are complex and proprietary. I am going to compare wired and wireless. The wireless is unregulated. It has progressed rapidly. It is extremely complex and changes all the time. Wired networks that are copper or fiber are simple stable technologies and are open. What you have is essentially a generation of wireless technology which is designed primarily to gather data about you. Wired networks particularly optical fiber, are much more secure than wireless.

Some of the risks of the wireless industry:

- Loss of community rights, property rights and rights of way for private corporate gain.
- A loss of revenues that come out of that is essentially a forced subsidization of your community to wireless by giving them stuff they would have to pay for.
- If 5G was not subsidized through this form, it would not be feasible.
- The loss of community environmental regulation is a critical factor. There are a lot of environmental implications to this technology.
- Risk to personal privacy and corporate and government surveillance.
- Risk to public health and safety. Vast literature on this suppressed by industry or ignored by federal regulators.
- Damage to the environment birds, bees, insects, plants, animals, tree, etc. particularly mm waves.
- The FCC limits are obsolete and they have no health expertise and have swept this under the rug.

What can states do?

- Let's get fiber to everybody. Fiber should be the first priority. Fiber is a basic utility like sewer, water, roads, etc. Wireless is an "adjunct service". The fiber should be owned and controlled by the municipality. This should not be privatized. Fiber access is superior to wireless in every respect except mobility. The fed has no policy on this and local power companies and rural electric companies are stringing fiber optic. It offers speed, stability and better privacy, safety in weather events, reliability and it's cheaper.
- Internet access is a necessity to modern life. You can't operate government today without the people having access to the internet.
- Cellular wireless is an energy hog as well.
- Community fiber would reduce the need for cellular wireless.
- Enable community fiber.
- Integration of distributed energy. Fiber will be needed for solar/storage and the future of the electric grid.
- Enable local control of cellular wireless facilities: Initiative in Colorado is repealing ALEX laws passed in 2017 which preempts local legislation.
- California just enacted CCPA (California Consumer Privacy Act). Take a look at this.
- Health and safety studies of EMF need to be supported.
- Enforcement of Environmental Protection laws. The appellate court just overturned part of the FCC order on the basis of its failure to enforce NEPA, the Environmental Protection Act.
- Antitrust enforcement and divestiture. The last thing we should do is allow merger between T-Mobile and Sprint. Fifteen AG's from states have filed a separate lawsuit challenging this merger.

- Read ,”The Book of Broken Promises” and do something about it. There is a case proceeding in the 10th district in Washington, DC in January on this investigation.
- Support the Green New Deal: 1/ a distributive solar micro grid and 2/fiber smart grid and optical fiber nationwide.

FCC has abdicated its responsibility to public health and safety as have other regulatory agencies.

FAA has failed to regulate creating a debacle which could sink Boeing.

California PUC has failed to regulate PG&E, one of the country’s largest utilities and is in bankruptcy largely due to the failure of regulators.

Another example of regulatory capture and the revolving door is now we have the FCC’s failure to investigate cellphone radiation, safety and their obsolete radiation limits which flies in the face of the NIH Toxicology Program study that shows cellphones can cause cancer.

Abrami: You have reinforced many of the things we have been talking about in this commission. What do you know about what is going on in China and their 5G rollout?

Schoechle: I submitted a paper ,” What is 5g and why do we care?” In it, it refers to China. It’s a financial driver in China and part of a surveillance state. It takes surveillance capitalism and the capitalists are the government.

Abrami: So we should be concerned about the chips and things coming from China?

Schoechle: It’s not just China. Korea is also a major manufacturer. They have become famous for LG, the television that are watches you. Those televisions are sending information to Google and Facebook and who knows where else on the internet. You don’t even know that is happening.

Sherman: Is there somebody in the legislature in Colorado that you have been working with who has been translating some of the work you have been doing into legislation or bills?

Schoechle: The majority leader is on board with this. I wrote a 20 page report named “Reclaiming local control over cellular wireless facilities”. I just sat down with a member of the House and went over that in great detail. We are looking for a sponsor for that bill. We are in recess right now. I can give you more detail on that if you want to follow up with me.

Sherman: That would be great. I am chair of Senate Health and Human Services. We try to not reinvent the wheel. If there is legislation enacted or in process that seems to be working through the system in Colorado that may be appropriate here in New Hampshire, we would like to take a look at that.

Schoechle: If you send me your contact information, I will try to facilitate that. The big focus in Colorado last session was major changes in energy policy. Electricity, oil and gas have been a major political debate in Colorado and we have made progress on that. Telecommunications will be in our next session.

Heroux: In your report in section 3.3.3 pg. 34, you say most of these sources never turn off and cannot be turned off. I believe you say this in context of IOT. Would you agree that the hardware switch on these devices would allow a person to eliminate radiation and eliminate transmission of information if the user wants to? Do you think it's feasible to implement or to legislate for such a device that would restore an individual's right to privacy and manage his radiation exposure?

Schoechle: That is a good question. The trend in the consumer electronics industry is to develop products that don't turn off. They look like they turn off and you think you turned it off but they are still on. This is a problem from an energy standpoint and from a data standpoint. I think what you are suggesting would be a good idea and we would have to look at how policy would influence the consumer electronics industry.

Heroux: You could design it that the switch is only disabling the transmission. You make it unable to send out data and you eliminate the radiation. You could also say that the fact that it is off, you do not disable the other functions of the device. It is a matter of engineering. We all depend on engineering. This type of switch could go a long way toward protecting privacy and making it possible for Electro-sensitive people to survive. How can this be imposed? Do we need IEEE to promote this? Do we need the Chinese government to promote this? How can this be achieved? You know industry well. If the goal is to restore that kind of power to the individual, what is the path to achieving this?

Schoechle: That is a wonderful question. I will have to think about that. It's not so simple. Particularly, with cloud data, the whole business model on these products is capturing that data. You are asking to change the business model for a whole industry. I agree with you completely. We will have to think that through very carefully but I think there is a path. Maybe the IEEE, but an organization called Consumer Technology Association (CTA) is more likely. I am on the cyber security committee and that would be a good focus for that. We are writing a new standard for consumer products. CTA2088. We also have an international committee that works on this. There is a concept of residential gateway for this as well. We could address it through standards and at least make that an option that people could buy.

Heroux: Since realizing that you are the best person probably anywhere to do this, I assume that we can count on your cooperation to further this idea perhaps in cooperation with the Committee in some form or other.

Schoechle: Absolutely yes!

Miller: I would like to explore your statement on enabling community fiber. You also said community fiber would reduce the need for cellular wireless. I am not sure I agree with that statement since we like to be mobile and fiber is not mobile. The other thing is why do you say community fiber owned and operated by municipalities?

Schoechle: Well, because for the municipality, there is a political process for governing it. If it is provided by a Century Link or Verizon, even if it's fiber, you don't have any control or assurances of net neutrality or if it will be equitably distributed in the community. You don't have that control. It's not something that should be privately controlled.

Miller: You go on to state that cooperative electric utility is a better model in some ways for smart grid which would be enabling fiber to the premise. That is not community controlled either. That's controlled by members through charter but not a community controlled network. So I am not sure what you mean, totally controlled by municipality? Or partnered with an electric coop to disperse fiber? Can you elaborate on that?

Schoechle: My first choice is municipal electricity and municipal fiber together. I consider the perfect model as Longmont, Colorado. They have done both of those. They have the most advanced fiber system in the country. That is preferred. But America is very diverse country. The rural electric associations are called coops. It is possible to go through the coops in a democratic way unlike a private corporation. They are like a Frankenstein monster, out of control and basically ungovernable.

We are looking at a new technology standard Ethernet cable Cat5 or Cat6 copper wire. This can carry data over short distances at the same speed as fiber. This can also deliver DC power. You can plug phones, computers to a USB connector throughout your home so you don't even have wireless in your home. That is coming... a USB connector standard USB3 type C something like that. This will be the new standard because this is the new internal wiring in cars will be gigabit ethernet.

Miller: This doesn't address mobile access. People want to be mobile.

Schoechle: I am saying it will lessen the dependence on mobile. Right now, if Verizon had their way, you would only have mobile access whether you want to be mobile or not. If you have fiber, you will have faster better service and when you are mobile, you have a mobile phone. I have a mobile phone and it's an old flip phone. If I want to do data, I use my laptop plugged in at home. I am not going to do that in a car driving around. People need the choice.

Sherman: I am not sure people would be quite so wedded to their phones if they were aware of the health impacts to themselves and the environment. If you were to take that new USB technology, would you be able to go to airplane mode on your phone and still have complete access to your phone? Would an on/off switch shut down antenna? Like an airplane mode for television or CPAP machine which is now wireless, as well? Would the concept of being able to shut down on all devices be what we are talking about?

Schoechle: Yes. It's analogous to airplane mode. Airplane mode is to prevent radiation for interference with aircraft systems. Right now many cell phones have a feature called wifi calling so you are not using cellular calling but using fiber access or whatever so you are not using cellular wireless network. Of course the cellular operators don't like that but all the phones now work that way. You could plug in your phone when you get in the house and turn off your cellular antenna and still have phone access.

Ricciardi: The town that I live in is entertaining fiber optics. We would have to put it on our ballot for the people to vote. I have two questions: I have heard different things. If we put fiber optic in, would that make it easier for 5G to come to our area? Would that give them a segway to attaching themselves?

Schoechle: That is a very good question. Many of my colleagues and I have arguments about this. Some say you are just going to enable 5G sites by putting in fiber. Well, that's why it needs to be democratically controlled by the people in the community.

Ricciardi: But my understanding is that the FCC can just allow them to come and put the 5G in. You won't have a say as a municipality. If that is the case, we would just be making it easier for them.

Schoechle: They can't make you use their fiber. The FCC ruling is just about siting, not the use of fiber.

Ricciardi: Oh, so it could help you keep 5G away.

Schoechle: The issue is not whether there will be fiber or not. The issue is who is going to own it and control it. That's the issue. If you put it in, you control it. If Verizon puts it in, they decide how it's used. That doesn't stop them from putting in 5G but they have to put in their own. They don't get their subsidy off of us.

Ricciardi: In the state of New Hampshire, our utilities are in the public right of way. There is a NH law that I have looked into. I have been looking into an ordinance for this. That is a factor in our state. It is a little difficult to overcome.

Schoechle: Yes. A lot of these laws were written that way and need to be revised. That's unfortunate. The goal should be Local Control.

Heroux: I have a comment about mobility. We need mobility. The cellphone industry has paid little attention to reducing exposure of users. There are some people who occupationally need to use the cellphone. They don't even have a choice. In other words, I recognize the right of people to accept EMR exposure if they want. However, there are people who do not have a choice to use the devices that are on the market. It is possible to reduce the exposure of a person by a factor of about a hundred if you make the proper engineering efforts to do so. You can have the exactly the same services you have now but your risk would be reduced a hundred fold by design of the antenna and software adjustments to the phone. There will be no loss of functionality however, an enormous loss of biological impact. Industry in the past has not done it. It needs to be told.

Schoechle: I agree completely. That is a very good point.

Abrami: Here's the issue. 5G is a concept that means something different to every one of the phone companies. They are all developing their own version of 5G which makes it hard to track. One thing for this commission will be a Health issue potentially and definitely a political issue is the deployment of these small cells at telephone pole heights in front of people's homes. That becomes a real intrusion. Regardless of what the science says, many people will say, I don't want that. We already know the

battles in our communities to put in a regular cellphone tower somewhere in the town, let alone a small cell in front of a home.

What is your view on that? We have engineers, doctors and toxicologists on this panel so we are having interesting conversations that really should be happening at the Federal level. What is going on in Colorado? Are there deployments of these small cell towers?

Schoechle: Well, yes. Verizon is rolling out in Denver. The issue has not come to Boulder yet. But the issue is what they have done with these ALEC laws and the FCC. They have lawyers that go around and tell city councils and county commissioners... oh.... you need to change your codes now to be in compliance with state and federal regulations. Our response is, let's change those. Of course that is a bigger hill to climb. People are getting up in arms because they are seeing the permitting of these small cells. Just the permitting has raised concern and communities are mobilizing around here. There are over a hundred cities around the country that have bonded together to sue the FCC. They have had some success. In November, there was a ruling in the 10th district. Industry wants to do this because 5G will need a shorter range. People don't realize that 4G and 5G will be bonded together. You cannot separate them. You will have both 4G and 5G. The new small cell sites being put in are 4G which will become 5G as well when they figure out what that's going to be. The technical standards aren't finished, the spectrum isn't allocated. 5G is an add-on to 4G which allows faster data transfer. It does not support voice communication. It doesn't support a lot of the things that your present cellular supports.

They talk about 5G for autonomous vehicles. I think that is a bunch of hype. There are safety issues that have not been addressed at all. It's marketing hype. The term 5G is a marketing term. It is not a technical term.

Sherman: My nephew is an engineer on the autonomous car, Waymo. They have no dependence on the internet. It is completely autonomous. So it's not just hype. It's a lie.

Schoechle: Right.

Abrami: Thank you for your time.

Schoechle: I would like to connect with the commenters. Thank you. I like the idea of technical standard approach to devices.

V. Next meeting: January 10 8:30-10:30 Devra Davis and Theodora Scarato

We are now going into Legislative Session. We need to do meetings on Monday or Friday. What about professors? Friday seems to work best.

VI. Meeting Adjourned at 10:35 am.

**NH COMMISSION TO STUDY THE ENVIRONMENTAL AND HEALTH EFFECTS
OF EVOLVING 5G TECHNOLOGY**

Meeting held:

1/10/2020

8:30-11:00am:

LOB 308

Meeting called to order by Rep Abrami at 8:30 am.

In attendance: (12)

Rep. Patrick Abrami-speaker of the house appointee

Rep. Ken Wells- speaker of the house appointee

Kent Chamberlin-UNH-appointed by the chancellor

Denise Ricciardi-public-appointed by the governor

Michele Roberge-DHHS- Commissioner of DHHS appointee

Dr. Paul Heroux- Professor of Toxicology, McGill University- speaker of the house appointee

Rep. Gary Woods-speaker of the house appointee

Senator Jim Gray-president of the senate appointee

Carol Miller-NH Business & Economic Affairs Dept.

Senator Tom Sherman-president of the senate appointee

Bethanne Cooley-CTIA , trade association for wireless industry and manufacturers

Brandon Garod-AG designee, Asst. AG Consumer Protection

Not present: (2)

Frank MacMillan, Jr. MD-NH Medical Society Environmental Medicine

David Juvet-Business and Industry Association

Agenda:

I. Approval of minutes from 12-13-19:

Minutes were approved. Unfortunately, the minutes were posted on our website prior to approval. We will make sure that does not happen again.

Abrami: Discussion about subcommittees and members meeting outside of the regular meetings. Small groups are allowed under the rule is 50%+1. If groups are larger, we will have to develop subcommittees.

II: Theodora Scarato, Executive Director Environmental Health Trust:

Environmental Health Trust is a scientific think tank. We coordinate with scientists all over the world on issues such as wireless, climate change and environmental health issues. Dr. Davis has long worked on climate change, toxic chemicals, environmental possible causes of breast cancer and toxins in the environment. I have a lot in a power point. I hope it will be useful for you. I will not get to everything in here as my focus will be on policy.

At EHT, we publish research and brief policy makers as well as develop educational campaigns for people and for parents on how do you reduce exposure. I have a lot of materials. The most recent paper I published was with Frank Clegg, former Microsoft Canada President. There are links to all of this and more in the power point and it's all hyperlinked.

The Babysafe Project: There is a campaign that we have co developed with Grassroots Environmental Education is called the Baby Safe Project. This campaign has been signed on to by over 240 doctors and scientists and educators, to reduce exposure to pregnant women and developing babies because of research showing brain impacts. Dr. Hugh Taylor, who presented at the press conference for this campaign talked about his research showing damaged memory and increased hyperactivity after cellphone radiation exposure to pregnant mice. There is other research that Dr. Davis will go into as well showing impact on brain cells to what would be legal exposure limits of radiation.

Many pregnant women take the phone and rest it on the abdomen because they don't know. People don't know to keep the device away from the abdomen or use safer technology and you won't get that exposure. I have a quote from Dr. Taylor, chief of Obstetrics at Yale. That might be someone that you would be interested in having to talk about his research. He has a quote: " I am deeply concerned about growing exposure to cellphones." There is a video online at the BabySafe Project where you can watch him talking about this with recommendations on how to reduce exposure.

Wireless and energy consumption: Health and environmental effects of 5G are not just about the radiation, it's also the energy consumption from all of these devices and all of the additional small cells. There is a French climate think tank report (The Shift Project) which talks about the explosion of energy use. Even though there are energy efficiency gains, they are not keeping up with the amount of devices and these new installations, which create an increase in energy use. They document that as well as the environmental effects and every part of the life cycle of devices. For example: You have conflict minerals, e-waste from disposing devices and energy use of the manufacturers. All of these are polluting our environment. This report has a short two pager which is useful for the highlights.

Insurance coverage: I know that one of the questions of the commission is: why don't insurance companies cover damages from electro- magnetic field exposure? As you probably know, in the annual reports of almost all of telecom companies are statements to the shareholders such as " If radio frequency emissions from wireless handsets or equipment on our communications infrastructure are demonstrated to cause negative health effects, potential future claims could adversely affect our operations, costs or revenues". "We currently do not maintain any significant insurance with respect to these matters."

We have a page on our website linking to all the annual reports with these statements. Why are shareholders being warned of potential risks in the future and not people? I got involved almost a decade ago because I am a parent. I did not believe this at all. I knew enough that I had to take some time to dig in and here I am.

We have list on our website that we try to have a repository with compendiums of information that has all the white papers of industry where the insurance companies rate EMF as a high emerging risk. The SwissRE report just came out rated 5G mobile networks: the impact is high. The quote in this report with regard to health effects is: "As the biological effects of EMF in general and 5G in particular are still being debated, potential claims for health impairments may come with a long latency." I think that's most people's concerns here.

The Harvard Center for Ethics Report: What's going on here? If there are all these studies showing adverse effects, why isn't there the follow up that we would all expect from an exposure this great? In this report, the investigative journalist talks about money that has gone to Congress and the way that the FCC has former telecom executives as commissioners and also when you retire from the FCC, many commissioners end up working for the industry. This is all documented and he also talks about the correlation to Big Tobacco. "It is these hardball tactics that recall 20th century Big Tobacco tactics." This report is from 2015 and I really want them to update it because so much has happened since in terms of this issue with the revolving door. The title of the report is: How the Federal Communications Commission Is Dominated by the Industries It Presumably Regulates by Norm Alster. There is also published research that has found industry involvement affecting the quality of the results, the design of the studies, sponsorship and publication bias just like there would be in most industries. The consulting firms of Big Tobacco are now working with Big Tech. There is a report out that we are looking at a 12.3 trillion dollar market.

Revolving Door: This is a slide that I made showing the Former FCC Chair, Tom Wheeler was the former head of CTIA, Ajit Pai, the current FCC Chair was formerly a Verizon counsel, Brendan Carr, FCC Commissioner who was a former lawyer for Wiley Rein LLP who represented the Wireless Industry in suing San Francisco for their Cell Phone Right to Know Ordinance. Bruce Romano, Asst. Legal Chief in the FCC's Office of Engineering and Tech went to the law firm of Wiley Rein representing the CTIA.

Short Timeline of US Regulatory Action on RF and Human Health: This is probably one of the most important slides that I have. You don't have it in your packet.

Abrami: please give us your non PDF versions of your files that we can click hyperlinks.

Scarato: I will do that. This is just a short timeline. It does not have everything in it.

In the 1970s-1990s, the EPA had a robust research program tasked with developing RF safety limits.

1996: the EPA was defunded and told that they could not work on EMF as they were set to release their phase one of safety limits which was on heating effects. The second phase was supposed to be on non-thermal.

1996 FCC adopted RFR exposure limits based largely on limits developed by industry and military connected groups (ANSI/IEEE C95.1-1992 and NCRP's 1986 Report).

We adopted those limits without our experts setting what is a safe limit? What is a safe limit for long term? What is a safe limit for children and pregnant women? Later in 2008, the National Academy of Sciences did a report documenting gaps in our understanding of the issue. What is going to be the impact of children exposed for a lifetime? That is my number one question. My background is as a social worker and I directed programs in schools. I worked with a lot of kids who were born of crack addicted parents. I know the differences between the kids. You have trauma, brain impacts from prenatal exposure. Kids who have been adopted and we know their history. That's what really brought me into this too. Knowing the challenges of my clients and knowing the impact that brain damage can have.

2001: GAO report and letters from experts in government saying there were problems with these limits. Those were not responded to. In 2008/2009, there were Congressional hearings on cell phone radiation.

2012: GAO Report: "FCC cannot ensure it is using a limit that reflects the latest research on RF energy exposure." Reassess RF limits and update phone compliance testing requirements.

2012: H.R. 6358 The Cell Phone Right to Know Act was proposed at the federal level and not passed. When I found out cell phones emitted non ionizing radiation, I thought what?? Why didn't I know that? My kids spent time on the phone because long distance was free and I spent hours on the phone talking to my girlfriends. I just wish I had known and I could have made that decision.

2013: FCC open inquiry proceedings (in response to GAO 2012 report) We have links to the docket and the submissions, doctors, scientists, industry, cities, lawyers.

2018: GAO listed status of the 2012 report as "closed/not implemented". But just recently, the FCC issued an item closing the inquiry, saying there is not science that says we need to update our limits. They based that on the FDA's opinion. There is a three page letter in the docket. You can see all of these.

Abrami: Just so you know Theodora, one of our goals is to try to get someone from the FCC to actually talk to us. We are a state. We are not the federal government. But I am not going to give up trying to get someone from FCC to answer our questions.

Scarato: I would hope the FCC as well as the FDA would answer your questions. We have questions. Scientists have been writing letters. I have a slide on letters that have not been responded to. I believe the American people need to have answers to these questions. What the FCC did on Dec 4, 2019 was to say there is no need to update the limits, "that we decline to revisit our RF exposure policy as it pertains to children". "Similarly, the FDA maintains that the scientific evidence does not show a danger to any users of cell phones from RF exposure, including children and teenagers" even though there was a submission in the docket on damaged brain cells.

There were submissions that said the testing of the phones should require zero spacing. They don't think that they need to. They think the information in devices is adequate to inform people of these issues. I think I am pretty smart and I did not know that information was there. I have a Samsung Android and I cannot find my SAR testing easily at all. It is not in my phone. It is not listed online. The only way is to go to the FCC and type in your model and make to figure it out. That is not adequate. I would expect more of our government.

Gray: Mr. Chairman. I do object to some of this testimony. Let me explain why. A lot of the testimony that we are getting right now is: somebody wrote a letter and we didn't get an answer. Somebody else wrote a letter and we didn't get an answer. I have sat through many hearings on vaccines and listened to this electromagnetic radiation all the way from when I was a teenager and we were worried about the power lines. I would love to hear the data that you have got. The experts from the FCC have said there is no scientific data out there. That's what I am interested in, the scientific data that deals with 5G, because that is the crux of this committee. If there is data about the scientific problems with 5g then I want to hear that but I don't want to hear that I wrote a letter and I didn't get an answer.

Abrami: Well, I don't disagree with you. We are trying to get at the essence of this. I want to talk to the FCC directly and the IEEE. We are still trying to get at the facts. We have talked a lot about the science on the commission probably more than any other state legislature. I am hearing conflicting things about the FCC. Did they look at biological effects or not? I want to know. It would help us as a commission to understand. As the Chair, I am not releasing a report if the FCC says X and we say Y without data to base that on. People will ask, just like you did. What did you base that on? The FCC says its fine. That's why we have to keep digging.

Sherman: I want to remind the commission that this is our guest. We don't usually shut down a guest because we don't like what they are saying. I would ask that we let her speak as invited and you can be your own filter for what she has to say rather than objecting to her testimony.

Woods: I understand the Senator's concern. But by the same token, even if we have scientific data, we need to know what context or social context this has been interpreted and conveyed. That is just as important to me. If we find that the FCC got a letter and didn't respond and we know there is a study about that, then that non response is important. I understand that data is important but the context and how it is conveyed is also important.

Abrami: The other thing Theodora, you are doing a great job laying this out. This commission is deep into the weeds on this. We don't know all of what you are saying here. We are filling in gaps so continue along your presentation. The other thing we will be talking about with Devra is we need to see that some of these studies are replicated. We can't look at a study and say that's bad if it's not replicated. For me to feel more comfortable, science has to be replicated.

Scarato: She is going to be talking about that. I had read the questions that your commission is tasked with. I was basing my presentation from the policy side based on those questions. I am trying to explain why and give you links to it. For example, the American Academy of Pediatrics sent a letter with concerns to the FCC. I felt it was important to talk about this.

Abrami: I agree. Public policy wise, like you said earlier, most people don't know you shouldn't keep it on your body. I did not know that myself until about a year ago. As a commission, we would really like to see what other states and municipalities are doing if you have that.

Scarato: I can fast forward to that.

Abrami: You may want to do that because we may run out of time.

Scarato: The Systematic Review: This is important. It is a gold standard and I want to point out that it hasn't been done. When scientists are writing letters, one of the questions asked is where is the systematic review? Where is the full report on all the studies and what they found and how to weigh them by independent experts? What does the science say as to what is a safe level? I know that is a question that you are looking at.

What do US Health Agencies say about NTP study? I am pointing this out because I think it's important for the commission to see what different federal agencies are saying on their websites about this issue. For example, on the National Cancer Institute, unless you know what you are doing, you would be hard pressed to even know what this study found. All they say is, "primary outcomes observed...". This is not what most of the American public would even know what that means. The FDA disagrees with findings of NTP yet no systematic review, no report, no citations, no FDA peer review. The CDC says nothing about NTP. EPA says nothing on NTP and sends you to the FCC. The EPA used to actually have statements on their site. We watch all the sites and you can see what they previously said. They had a statement about an open question of safety, but that's been changed.

2014 The Department of Interior letter states "however, the electromagnetic radiation standards used by the FCC continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable to today".

2002 EPA letter to the EMR network of VT: "federal health and safety agencies have not yet developed policies concerning possible risk from long-term, non-thermal exposures"- Robert Hankin, EPA,2002.

FDA: Scientists 2019 letters to the FDA that have not been answered.

NTP: Ron Melnick is a 28 year NIH senior scientist, who lead the design of the NTP study. He has published how there are unfounded criticisms of the NTP and addresses that.

The FCC said testing phones are zero mm is unnecessary. Women put their cellphones in their bra. I can probably find three or four women on the street in DC who carry their phones in their bra because they don't know. Phones are always radiating even when you are not on them. They say that operating instructions are adequate. Kids don't know.

Abrami: Theodora, please for the sake of time, it would be great if you get to what states or municipalities are doing.

Scarato: Montgomery County, MD has a federal court challenge to the FCC. This was filed before the FCC did its filing stating they don't need to update the limits. This case is still proceeding. How can the FCC be streamlining 5G when they haven't completed their inquiry? The FCC should complete the 2013 review before issuing 5G streamlining order. See the links to [Putting the cart before the horse-“FCC’s 5G first, safety second” policy](#) by Albert Catalan, Eric Gotting and Timothy Doughty, the Journal of Local Government Law. That's one of the lawsuits to know about. I have a link to the filing.

Cooley: Mr. Chairman and Ms. Scarato, I don't mean to interrupt but I think there needs to be some clarification to that slide. The way that you characterize it is that Montgomery County is suing on RF grounds. Montgomery County raised the RF issue in light of the FCC's state and local item with respect to streamlining 5G facilities. I think that's an important clarification for the minutes. I hope I wasn't disrespectful by interrupting you but I wanted to make that point.

Scarato: I hope I was clear on that. What they are saying is, how can you streamline 5G without having finalized the inquiry preceding it or pushing something forward without having done the review?... not that there is a health problem. That is what I meant if I wasn't clear on that.

Cooley: I believe that Montgomery filed again though after the FCC item on Dec 4th. I would like that to be clarified.

Scarato: Oh. I know they are continuing their case.

Cooley: They are continuing their case. I am not disputing that.

Abrami: Theodora, you may want to check that out and get back to us.

Scarato: Yes. I will

Letters from Senators: We have links on our site of senators who have written letters to FCC and FDA, asking for their review on 5G and their letters.

Lawsuits: I wanted to point out two lawsuits: 1/ Irregularators vs FCC and the Fegan Scott lawsuit. Irregularators lawsuit alleges that there was money for maintenance of wired lines that was switched to wireless. I am summarizing. The Fegan Scott lawsuit is about separation distance in phones.

NEPA decision: The FCC's action to streamline 5G, has stripped local authority with regard to infrastructure. There was an appeal by the National Resources Defense Council and Native American Tribes that was won. There needs to be compliance with NEPA (National Environmental Policy Act) for small cell and wireless facilities. Cities and states have argued about amount of caps and leasing spots. There are two separate cases. The FCC has vacated a part of their order saying they do not have to be in compliance with NEPA. So now, small cells need to be certified it meets NEPA requirements. The NRDC did a Q&A about what this means in terms of municipalities. I will provide a link to that.

Federal level: Three Bi Partisan bills on 5G passed the House at the federal level. (H. Res. 575, H.R. 2881, H.R 4500)

Local ordinances: Cities and towns have been coming up with in order to address this because many people say ,I don't want these in my front yard and what do we do? Then they realize they don't have an ordinance in place to handle it. They don't have a permitting process. They don't have any kind of authority. Cities and towns are trying to find out what authority they have and make the most of it. Examples: (City of Los Altos: installation of small cells on public utility easements in residential neighborhoods is prohibited; 500 ft. set back from schools; 500 ft setback for multi-family residences in commercial districts; 1500 ft separation between installations)(Petaluma: 1500 foot minimum separation; No small cell shall be within 250 ft of any residence)(Bedford, NH: 750 foot setback in residential) (Burlington, MA: annual recertification fees; applicant must pay for legal notices of public hearing) (Fairfax, CA: small cells prohibited in residential zones; 1500 ft separation; city to study citywide fiber optic cable network)

Example of issues that come up from lack of infrastructure and permitting/compliance: I will tell you what happened in our town. On this slide, that small cell on private property is illegal even when it was placed on private property six years ago. It was placed there even though the permit was for down the road. The owner repeatedly testifies asking, can you please remove this from my property? Everyone says they can't because no one has authority. It is still there. What is happening is that there isn't the infrastructure that there needs to be to oversee the permitting process that needs to be done. Community members started looking in to this and found several permits that were incomplete and over a dozen that were placed where they shouldn't be placed. Then there is the whole issue on, why can't this woman get that removed from her home? You could have a whole meeting on permitting, review and compliance.

Sherman: I don't understand. We already have utility poles and rights of ways. If this is in violation, why doesn't it fall into the utility right our way or violation thereof and why can't it be removed on existing statute? For example, in Rye there are double telephone poles going in and they are failing to remove the old poles. That's a violation of the right of way and now will be removed. I don't understand why this would take five years if they are in violation of the right of way.

Scarato: I am not going to profess to know all of the details of it. You can watch her present just a few months ago. Every jurisdiction has different policies.

Abrami: I know this isn't the science part of our discussion. 5G means something different to everyone. Different companies are rolling out differently. We are concerned what's in those antennas, how much power is coming from them, how far away should they be from each other, a home or business. Eventually, we will get to that. From a policy stand point, we have to understand the science to be able to make intelligent recommendations Just from an aesthetic standpoint, as a homeowner, I would be upset too. We need to separate the aesthetics from a science too. Some people just don't want it for aesthetic reasons. We are concerned about both because there will be push back. We are trying to get ahead of the curve and understand the science.

Scarato: We all had that question but it's quite complex because every antenna or small cell facility will have different antenna depending on the network using a variety of frequencies. 4G is a backbone of 5G, as I understand it. There is a study that came out that I don't know if Dr. Davis will talk about. There is a study that looked at small cells in communities and communities without them and found there will be an overall increase in environmental level. Industry will say it's negligible. Scientists looking at biological effects will say it's important to consider, I believe. I don't want to speak for anyone but I know that is what is being put forward. That's a good question. We aren't getting 5G but are getting 4G and they put cells 2-10 homes.

Abrami: Usually, we hear of 5G in mm waves, further up the spectrum.

Scarato: But they aren't going to be using only mm waves. They are also using low, mid and high band frequencies, at least from the CTIA report. All of those frequencies will be utilized in 5G depending on the carrier and location. So, to say it's only mm waves is...

Abrami: Every company is different is my guess.

Scarato: What can cities do to retain their authority? Many cities want to retain as much authority as possible related to 5G. There are now 120 cities in Italy passing resolutions on 5G. In Cyprus, they removed wireless from pediatric units and provide safety information for parents. Internationally, is all online on our website EHTrust.org.

Cooley: Thank you for your presentation. We can talk about what is happening internationally but the US has a unique set of laws. In terms of what cities can do, we have to remember the FCC state and local order is the law of the land. It went into effect in January 2019. Yes, it is being litigated. Oral arguments are February 10th in the Ninth Circuit in Pasadena, CA. As we are looking at policy recommendations, we have to remember there is federal law. There is also the Communications Act section 332, specifically which we should delve into because other states are looking at what they can and cannot do in this space. I want to frame that properly. Yes, there are ordinances around historic preservation, aesthetics that cities can look at. But in terms of legal framework, I don't think New Hampshire would want to be inviting litigation by recommending something that would perhaps run afoul of federal law. On that slide, I wanted to make that point.

Scarato: I would expect that lawyers would assure that local, state and federal law was being evaluated depending upon where you are. There is a lot that you can do and a lot that you can't do. There is a lot that cities can do actually.

Cooley: Yes. Absolutely, I am not disagreeing with that. The only other point I wanted to make. You mentioned a Federal Right to Know law that was introduced in Congress in the early 2000s and you mentioned the San Francisco Right to Know Ordinance which you seem to allude could be something the commission could look at.

Scarato: As I understand, San Francisco continued their arguments and decided to pull out because whoever won would have to pay the court fees and it was not implemented.

Cooley: That's correct. It was never implemented.

Scarato: Also, the Berkley cell phone law did pass which I did not talk about. It basically says that people have the right to know when they buy a phone from a retailer that if it touches the body, it could exceed FCC limits. The Supreme Court let it stand.

Cooley: It was not implemented.

Scarato: Right.

Roberge: On your slide that had cities with protective ordinances, you use the term facilities in terms of setbacks for facilities. Are you referring to antennas?

Scarato: When I said facilities it refers to the installation of equipment and antenna.

Roberge: I just wanted to make sure we were talking about antenna and equipment not a facility as in a building.

Sherman: I have a quick question. With multiple different networks and multiple different carriers in any one municipality are there multiple different 5G networks being proposed? Does each one emit a certain amount of radiation? If for example, you have T-Mobile and Verizon in same setting, what does that mean for total exposure for the public? Is it double? How does that work?

Abrami: To add to that question. Currently, there are towers with multiple antenna, will there be sharing?

Cooley: Yes, there will be sharing and Theodora made a great point. Carriers will be using different frequencies. T-Mobile for example, their 5G will mostly be on their existing macro towers. So they are going to be 200 feet in the air vs Verizon or AT&T who might be using the millimeter wave on that light pole. It's not kind of a yes or no answer.

Sherman: If we are in Concord and we have T-Mobile, Verizon, AT&T all providing service, are we going to have three different networks to which we are exposed all at the same time? Or is it one shared network? The ultimate question is does it mean are we going to have 3X the 5G exposure? And what does that mean?

Cooley: I am not an engineer but the answer is no. Depending on the facility being used, they are going to have different power levels which will change the amount of non-ionizing being emitted. So, it's not really apples to apples to say.... you've got one Verizon, one AT&T, one Sprint and one T-Mobile because they are probably not all going to be on the same facility because they are using different spectrum frequencies. So, it's not just to say, Yes.... You will increase by four. This is really an engineering question.

Scarato: While that's true, it's also true they don't want to share installations. It came up in Washington, DC. They don't want to share a hotel but that means that different carriers don't want to share an installation. Each will have its network rolled out. You will get the increases.

Cooley: But that's specific to DC. There are locations where hoteling does occur and carriers share one pole. It's completely specific on the network needs and the spectrum being used.

Abrami: We have an engineer right here with a question.

Gray: I wanted to go back and defend my comments in the middle of the presentation. When a guest is asked to come given the criteria, I expect certain things from that guest. I don't expect to get bombarded with health things that are trying to tug on my heart strings, other information that doesn't go back and say yes. We have this but here is the data that I can look at that says this is happening. I've got a lot of people from Health and Human Services coming to talk to me about vaccines that say here is anecdotal information that this person ended up with because of that vaccine. We go through this whole presentation and we say, so what real data did they present at all that says here is this radiation, this frequency of radiation, this level of radiation that caused these things and that is why we are protecting you. So, when we go further than that and you say there are a bunch of cities out there who have regulated placement of antennas. What information did they use to regulate that? If it's clearly identified information then everybody across the country would have done it. Or is it because they were scared? I am on the planning board and City Council in Rochester. There are people there who would like to regulate all kinds of things. It's just like the environmental thing, global warming. Give me data. Don't give me, I asked a question and I didn't get an answer.

Scarato: Dr. Davis will be talking about that data and all that data is on our website. Dr. Davis is presenting the science. I am presenting the policy.

Abrami: Yes, Theodora. You did exactly what I asked you to do. I was trying to get a sense what's going on around the country related to this in terms of ordinances and states taking action and all of that. We, as a commission are doing a pretty good job of not taking things on face value. We are trying to understand the science. This may have not met your needs today on this but we are trying to get as much information on this as we can. I understand your position, Senator Gray. When I talked to Devra the other day, I told her what I want to know is what studies have been replicated multiple times.

We will be meeting through October on this and we will continue to try to bring in the right people. We have the outlines and the picture and we have a lot of filling in to do as a commission. Thank you for your comments but our guests are our guests. As a commission, we do appreciate you coming here.

Wells: I just want to make a quick point from a moment ago, just to clarify the science of electric fields and magnetic fields. When we talk about electromagnetic radiation, they are additive. It does not depend on the frequency you are talking about. It does not depend upon what brand name it is or the locality. It's called the superposition principle. If you have multiple carriers in an area, they will overlap and add.

Sherman: I think that answered my question.

Chamberlin: The 1996 Telecommunications Act says that health effects from exposure to radiation cannot be used for objecting siting. How does that come into play or does it come into play in the legislation you are familiar with?

Scarato: Well, it says that concerns about environmental effects cannot be used in the siting of facilities. This was then interpreted by case law and lawsuits to be health concerns. If there is a community and people only talk about health concerns and the city says because of these health concerns our citizens have, we are not going to site the tower, then they can be sued. People say don't we have a right? How can this be? (Section 704 of the 1996 Telecom Act) I didn't mention this, but at that time, this was the most heavily lobbied bill in the United States. The lobbying only increased after. The amount of money that went into that bill was pretty impressive. I would say that everyone should be able to have their time in court to argue if they have been harmed.

Cooley: I would add that there is litigation just filed yesterday actually in Camden County, Georgia with Verizon. They are suing on the merits of that very issue. The FCC has exclusive jurisdiction over regulating anything that emits RF. So, if a locality does violate that, they may see litigation as we saw yesterday.

Scarato: Several times companies or CTIA have sued and they haven't always won. They haven't always talked about health issues but aesthetics and other things.

Sherman: For my part, I found this very helpful. So, thank you for coming. We are trying to make our decisions on whether or not to move forward or how to move forward based on as much science as we can. You have given us a nice framework on what others are doing in terms of implementing policy. With your help, there has been for me a nice framework on what are the limits of our capacity to do so.

One of the most troubling parts to all of this and you are not the only one who has shared this with us, so you are not alone is that it sounds like the FCC has sole jurisdiction over what happens with the rollout of these networks, yet they are completely in bed with industry.

In the medical world, which I represent, we have a similar problem with pharma and their regulation and the FDA. This is not something this commission can take on but you provided a framework in a nice way to help us understand what are the limits of policy that we could actually consider and roll out if we wanted to provide regulation. Thank you for coming and providing some of that perspective. I think we need both policy and science. So this has been helpful.

Heroux: I would like to address you as representative of CTIA. I just want to drag you out of your comfort zone. As a specialist, I have heard hundreds of reports of deleterious effects of electromagnetic radiation, and you have sat very patiently as we outlined these things in sessions.

What about the positive effects of cellphone use? What I mean by that is, if because of wireless and a cellphone, I can avoid a car trip and then perhaps a car accident. Then surely there are benefits to this,

right? There are benefits to the use of wireless. Has the CTIA supported and documented the benefits to using wireless? After all, we have to balance the negative with the positive.

Cooley: Thank you so much for that question. This is a policy question, right in my wheelhouse. Absolutely, I will do a plug for CTIA.org. Accenture and Deloitte have done host of studies on the benefits of what 5G will bring to this country. Nationally, 3 million new jobs, 500 billion contributed to the US GDP.

Heroux: I am sorry. I don't mean about economic activity because that is dollars that can go one place or another. I am talking about avoiding deaths and diseases. Surely, wireless has substantial capability. I perceive that your industry has not documented these things in great detail but have been driven by an alternative variable, which is commercial success. In other words, if things are bought, people want them. So this is an index on how useful they are. My point is...we love potato chips but we can have trans-fat potato chips. You see where I am going?

Cooley: Yes. The benefits of 5G for remote health care. If you live in a rural area and you don't want to have to drive into the city or remote surgery. AT&T is doing some really exciting stuff. There is the first 5G hospital at Rush hospital in Chicago. There are absolutely benefits to consumers and society and agriculture. Drones survey networks so we can see where people are without service. We need to save them if their houses are on fire so we can communicate with first responders, so yes. There is a ton of research on that and independent agencies as well. I would be happy to provide this commission with those studies.

Heroux: Most of those things like remote surgery doesn't need 5G. It can use fiber optics. What I am talking about is specifics. So you could come up with a report that would document the advantages of wireless specifically independent of data transmission. We have not seen that much documentation on this aspect of it. Ultimately, we will have to balance these things right?

Cooley: I am happy to share those use cases with the commission because I disagree.

Abrami: yes. I would agree.

Cooley: I am happy to share those reports we have right now and there are a host of reports coming out, I think second quarter of this year that are not CTIA. We don't do the research. Other entities do the research. I am happy to share those.

III.Devra Davis PhD, MPH, President, Environmental Health Trust (via speakerphone):

I have been working in science at some of the highest levels for many years. We started Environmental Health Trust when I was at the University of Pittsburgh Cancer Institute, where I had set up the Center for Environmental Pharmacology. I worked as a member of the President's Cancer Panel. I was

confirmed by the Senate. So, I have been around for a while. I have written two books. The most relevant and recent book is "Disconnect: The Truth About Cell Phone Radiation".

I am going to first explain that when it comes to getting information about any toxic agent whether it is chemical or in this case, RF, we look at experimental studies including *modeling* of exposure. Please understand that that is all we have for exposure. We can't go inside the brain and actually pick up exposure when it comes to humans. What we can do is use computer simulations that are anatomically based on models of the human brain including specific parts of it that are relevant. I will talk about today, particularly the hippocampus. We can fairly accurately model those. Those models have been validated and are used right now. Some of the models I am going to show you are used to set the standards for surgery or approval of equipment by the FDA.

Then there is *in vivo* testing which means whole animals. We take animals and expose them usually over a period of several weeks or some time for two years. Rarely, are animals exposed from before birth to their death.

Next we have *in vitro* studies which look at cell cultures either animal or human cells to measure DNA damage or other things that happen in cells. Those studies, I want to stress are done in order to predict human effects and prevent them. That is why every drug that you take is subject to animal testing. The same standards being applied to testing drugs have been applied to testing RF. Please keep in mind that everything we know for certain causes cancer in people because we have data for example from asbestos or arsenic will produce it in animals.

In terms of *ecological* studies, we can look at trees and grasses. There are experimental studies as well on bees and other smaller animals.

Finally, we have *epidemiology*, the study of people and I am a fellow at the American College of Epidemiology. I was also a member of the American College of Toxicology. So, I am familiar with both of these overall approaches both, toxicology and epidemiology.

For epidemiology, *cohort* studies are the weakest form of analysis that we have. In the case of what we are looking at for brain cancer, we cannot follow people through their entire lifetime with detailed information. We therefore rely on case control studies of those with the disease and compare those to others who do not have this disease but are otherwise similar.

The next slide shows you a child. It explains that because of the modelling studies that have been done, we can conclude without question, that children will absorb more RF into the brain soft tissue inside the skull and 10x more into the bone marrow of the skull, compared to adults.

Virtual reality simulations: I just showed that to you because virtual reality is a very cool and exciting thing but the way it is often used is with wireless transmissions and when you have a microwave radio right in front of the eyes and frontal lobe, you are getting greater exposure if you look carefully through the top of the skull of the six year old on the right side. You can see much greater penetration into both eyes and we are very concerned about the eyes of children right now from a number of exposures.

Summary of the EU REFLEX Project: The European Union in about 2000, funded about ten million dollars for twelve different research labs in seven countries. They were asked to look at the question of whether or not the same radiation that would be received from cell phones could break DNA in a variety of human cells and by the way including brain cells and human lymphocytes and fibroblasts. The conclusion of that study, much to the surprise of the people doing it, was that they found clear evidence of DNA damage. At the beginning, when they first found positive results, they assumed they had faulty equipment. They had so much money that they went out and bought new equipment to test things. Those of you with a medical backgrounds, which I am pleased to know are on your commission and also part of your legal body there, understand that being able to buy new equipment means you have a lot of money. The results shocked the researchers. They clearly showed changes in gene and protein expression in several different cell lines. Interestingly, they did not show damage in the mature human cell line. Damage was much greater in human fibroblasts and human cell lines that are less mature, stem cells.

Abrami: Can you go back to that slide please? So, they replicated a study that was done in 1994 but it was a 2004 study they replicated again?

Davis: Yes. In 1994, Lai and Singh produced a study showing damage to the brain of the rat from cell phone radiation, DNA damage. They were shocked by the results. They did the study all over again. When they were about to publish the results, the industry engaged in what was called "War Games". That was the strategy and what it was called in 1994. Remember, in 1994, very few people used cell phones (about 10%). People in industry understood the importance of this, went to the journal that accepted the article for publication and tried to get it unaccepted. They went to the NIH and accused the researchers of fraud and went to great lengths to conduct what they called War Games. That was 1994. In 2004, when another group was asked to see if there was anything to this, they were confident they would find nothing. In 2004, they replicated it.

Abrami: This is the EU REFLEX group.

Davis: The Comet Assay: Right but there's more. I'd like to show you more about the replication of the DNA on deregulation of cell proliferation and exaggerated programmed cell death otherwise called apoptosis and genotoxic effects all show from very little exposure. The next slide is a summary from there (The Comet Assay). You can see the sham or the perfect cell on the left is a cell with no DNA damage. When you have damage, you get a common tail. See the tail on the top right and the bottom. In 1994, those tails were only measured by somebody looking at them and giving you an estimate of what percent tail there was. Now we have much more sophisticated ways of automating the measure and extent of that tail. The top right is damage from gamma radiation like you would get from massive exposure from a CT scan which could happen in a pediatric CT scan where the scanner is not properly set. The top left slide is your control. The far right on the top is the impact of gamma radiation from xray like pediatric CT scan gives you that much exposure. The bottom right was what they achieved after 24 hours of exposure to mobile phone like radiation at 1.3 watts/kg.

Abrami: Is that continuous exposure for 24 hours?

Davis: Yes. It was exposure like a cellphone. A cellphone is not continuous. Within four seconds, you get huge changes in power density over time.

Abrami: I am trying to understand how far away that cellphone was from the eyes. This is eyes right?

Davis: No. These are not eyes. These are cells taken from the brain.

Heroux: It is slightly lower than the FCC SAR limit.

Davis: It was below the US current standard of 1.6 watts/kg.

Subsequent work confirms the REFLEX project. They showed clear evidence non- thermal microwaves from mobile phones affected repair of DNA in human cells. They showed the same effects at the GSM frequency of 915Mhz. These studies referenced at the bottom of the slide, were all produced subsequent to the REFLEX Project from 2004, 2005 and 2009.

Abrami: so there are four other studies listed there?

Davis: That's correct.

Sherman: All of those corroborate the findings of DNA damage?

Davis: That is correct. Further, the next slide is from Lerchl.

Lerchl: Lerchl was widely known as a skeptic of any of this. In 2015, Lerchl started with exposure at conception. The rodent reproduces in three weeks. In a very short time, you can follow these animals through their lifetime. Then the equivalent of early childhood, the animal was injected with a known carcinogen, something that we know causes cancer (ENU). Then, those animals were subsequently exposed to RF exposure. The levels of exposure were .04 watt/kg, .4 watts/kg and 2 watts/kg. What you can see is that the control animal developed very few liver cancers. The ones exposed to the carcinogens developed more. But the ones exposed to cellphone radiation developed far more. Much to the surprise of the investigator, they were able to show that the mice exposed in the womb to a known cancer agent, then exposed to cellphone, had significantly higher rates of cancer, tumors to the lung and liver. The study was designed to replicate an earlier study by Tillman, also of Germany. When he first presented his results, said they were remarkable. His study was ignored. Lerchl found higher rates of cancer in all of these mice. Also survival times of the animals were much lower of those who were exposed. This was a very powerful replication as well and further replication because you had asked me, Mr. Abrami about focusing on replications.

The NTP study: You already heard about this so I won't go into that. But, I want to remind you that what is on the website of the National Toxicology Program right now summarizes this information. It states clear evidence of tumors in the *heart* of male rats. I want to stress these are very rare cancers. I suppose in a way, that's the good news. There was also some evidence of tumors in the brain of male rats, again rare. There were multiple cancers in other organs, some of which did not achieve statistical significance

but were still elevated. In the NTP study, they said, not only do we have evidence of cancer but precancerous conditions of the heart, meaning damage to the heart. This is quite worrisome.

The publication that came out from NTP shows DNA damage to the *frontal cortex* of both rats and mice. I want to stress that although the cancer showed up only in the rats, the DNA damage showed up in both the rats and mice. There is clear evidence of replication of results of DNA damage. The cancer results are also replications. This is not a one off study.

I want to stress something about the frontal cortex. It's really hard to get mice to make phone calls. That is why the exposure has been carefully calculated not to increase the temperature of the animal but to allow whole body exposure that simulates the kinds of exposures that can occur today.

Slide 14 and 15 give you a much more detailed analysis of NTP. Slide 14 looks at the tail of DNA using computers now. In 1994, they had people who could just look at the tail. Now we have computers to do it. They can score the number of cells in terms of the evidence of fragmentation of the DNA. Zero is your control. You will have some fragmentation of DNA just because that's life. We are breathing. We have sunlight. We get DNA damage all the time. If we are healthy, we eat our broccoli and sleep in the dark, we will have repair of our DNA. This is showing that exposure to CDMA which is a type of cellphone radiation. You get statistically significant damage indicated in the male rat *hippocampus*. The hippocampus is what allows us balance, memory and impulse control. It has been well studied in many different systems and shown to be damaged by exposure to cell phone radiation. Slide 14 is showing you the rat and slide 15 is showing you the mice.

Slide 15 shows the effects to mice are in the *frontal cortex*. In the rat, it was the *hippocampus*. Slide 16 discusses the implication of the NTP result. Dr. Melnick was involved in setting up the study originally in 2008. The study was designed to test whether or not heat was the only effect. They set up a study that did not heat up the animals. That design was carefully calculated by Swiss engineers using methods that are validated, they were able to show results that I just showed you, increases in brain tumors, increases in heart as well as DNA damage in multiple organs in both rats and mice.

Abrami: Is that the replicated study that was done?

Davis: Yes. Smith-Roe is the first author of that study that was just finally published in 2019. Dr. Melnick and I and many others believe that the FCC by issuing its latest order saying we are going to be keeping our 23 year old standard for RF is ignoring this body of evidence I just showed you and more. I would like to show you a little bit more.

Gray: Before you leave that. The radiation that you applied is less than what it would take to heat. What is that in relationship to normal radiation from a cellphone an inch away from the head?

Davis: Thank you for that question. It is the same radiation you would get from a phone and they did it with ten minutes off and ten minutes on simulating the way we are exposed. As you may be aware, even when a phone is in your pocket as long as it's turned on, it's constantly checking for signals from a tower.

Gray: I understood that it was the same radiation. What is the level of radiation? I want to know if the radiation that I would get from a cellphone an inch away from head is a higher level than what these rats and mice would have experienced just below the level that would cause heating.

Davis: Well as a matter of fact. I am really glad you asked that because the answer is we get more exposure from our phones than these rats got. The reason we know that is because I assume you have seen the results of the Chicago Tribune test. Have you?

Abrami: No.

Davis: Theodora, I think you should show them the 60 second video of the test from Chicago. Do you have that? The Canadian Broadcasting Corporation, the French government and most recently the Chicago Tribune have actually taken real phones and tested them. They have found that the phones when in your pocket emit actually more radiation than the NTP study. The NTP test, tested the amount that they are supposed to emit. The Chicago Tribune paid for independent testing at an FCC approved lab. They took phones off the shelf and what you may not be aware of is that the way phones are tested today. They are provided by the manufacturer to a test facility and they select the phone to be tested. There is a whole scandal about that because as it turns out when you do that, of course the phones pass the test. When you take phones that you can buy and test them next to the body, they all fail the current test. (Nine out of ten of them to be precise) They fail it by as much as five fold in the United States.

Sherman: That is significant, what she just said.

Scarato: I wanted to say that when you put a phone near your body, you are getting an intense localized exposure near where the phone is. NTP did that at localized exposure, not the full body number. They wanted to see what the intensity would do to the tissues. This is not a whole body number but a localized number that we are talking about when we are comparing. The FCC occupational limit is 8.

Abrami: So, when they did the test and took the phones off the shelf what did they do?

Scarato: They measured the SAR levels at body contact and at 2mm and the French government measured hundreds of phones and body contact and found excesses of the limit.

Abrami: Most of the public is putting it next to the body because they don't read the fine print.

Sherman: I am trying to get at what is the significance of exceeding by five fold in the Tribune test? What does that mean to us?

Davis: The significance of the Chicago Tribune test should be that it would call for re-examining the whole test approach.

Sherman: So we are basing the emissions coming from phones based upon the tests done by the manufacturers under FCC guidelines but these independent tests in Europe and by the Chicago Tribune

and Canada are showing no, that's not necessarily the case. We may be getting five times that exposure of RF. Is that correct?

Davis: That is perfectly said. Thank you.

Scarato: in high exposure conditions.

Cooley: I just want to add to the record from that Chicago Tribune story which came out in August. The FCC immediately opened an investigation to look into that. On December 19th, after doing their own independent investigation, the FCC published a report saying they tested the same models and found all of them compliant with the FCC exposure limits.

Sherman: This is the FCC that currently has every member as a member of industry, former, future or current. Is that correct?

Cooley: The commissioners. If we are talking about the "Captured Agency" slide that Theodora had. The commissioners don't do the testing.

Sherman: No. But they are the ones who approve what comes out. It's like an Editorial Board. Is that correct?

Cooley: I don't know how or if they approve of a report. I don't know that process.

Davis: The protocol for the FCC was developed based on the assumptions that the only effects that needed to be avoided were heating. The tests were developed 23 years ago when phones were solely used by medical and business people. How many of you used a phone 23 years ago?

Sherman: I did.

Davis: Well, you are probably the physician in the room.

Sherman: yes.

Davis: My dad was a brigadier general and he also had one but very few people with normal jobs had phones. It was only about 10%. That's when phone protocols were set up and they were set up to be tested up to an inch away from the body because they would be in a holster which is the way people had pagers and phones in those days. They didn't carry them. They had them in a holster.

Scarato: Can I clarify what Beth is saying here? When the FCC did their test after Chicago Tribune, they tested at 5mm from the body. They didn't test at zero mm which was the whole point. They said they are compliant but if you look at the test report, it says 5mm. Then the news headlines read, "they are compliant". But it says right on the report... 5mm. The issue is people have close contact.

Gray: The 5mm problem bothers me alright? The reason it bothers me is there are 2.54 mm per inch so if I take 5mm, I am at a quarter of an inch or so and when I look at where the antenna is in the phone because there is a spacing there, I would think that 5mm is probably a pretty good distance when I have the phone right up to my ear.

Davis: It turns out that the antenna in the old days were towards the head. The newer antennae are toward the thyroid and lower. Your smart phone can have four or five antenna: One for data, one for video, one for voice, one for satellite GPS which is not RF. You have multiple antennae now that are located lower in the phone. We are now concerned that one of the explanations, not the only one but one of the explanations for the increase in thyroid cancer could be cellphone radiation.

Ramazzini: (slide 18) I do very much appreciate the opportunity to speak to all of you. I am delighted and honored to be able to speak to you and the fact that you exist really means a lot to all of us that have been working on this issue for quite a while. I never imagined I would be spending a decade or more of my life on this. I previously worked on lead and asbestos and I thought this would be a pretty simple issue but it's not simple. Ramazzini did a study like Lehrcl but they took thousands of animals and exposed them at different levels before and at conception and followed them until they died.

Their results on slide 19 was to show damage, the same type of damage that the NTP found at levels of exposure to their animals that were far less than NTP. In particular, they showed a *synergy* between RF and xrays (gamma radiation). *This is really important because it shows there is an additive effect between RF and gamma radiation (xrays).*

Abrami: the Ramazzini study was an independent study basically in parallel?

Davis: yes. It is the equivalent of the NTP for Italy.

Uptake of glucose in the brain: Slide 20 is a summary of a paper that was published in JAMA by some of the top researchers of the US government, the Director of the National Institute of Drug Abuse on the effects of cellphone exposure to the uptake of glucose in the brain.

Slide 21 shows the study design. A person with two cellphones strapped to their head. The study was done more than a decade ago. They had a PET scan which can measure the uptake of glucose in the brain. The person with a phone strapped to their head did not know whether the phone had been turned on or not.

Slide 22 is the results. If you look at the slide to the right, it shows the increase in glucose in the parts the brain that got the most exposure. Look at the slides comparing glucose uptake when the phones were turned off compared to the slide with the phones on. Look at the increased amount of glucose in the exact part of the brain there was the exposure. Why is that important? *Alzheimers* has been called *diabetes of the brain* because people with Alzheimers have too much glucose in the brain. Nobody knows the consequence of having too much glucose in the brain from holding a phone next to your head. It remains unknown. This study was subject to "War Games" as well.

Slide 23 explains part of what might be going on. You will see the control on the left without exposure. The slide on the right shows little tiny dark spots of damage, *indicating that the blood brain barrier has been breached.* At the bottom of the slide you will see references.

Abrami: is this a human brain? Or no?

Davis: oh no. We can't do that. These are Sprague Dawley rats.

Davis: at the bottom of the slide you will see references to subsequent studies. The first study showing this was in 1975. Alan Frey did that work. Cold War was still on and radar is a vital part of it and he was basically told to stop doing research. All of that is documented in my book.

What happens when you have a cellphone in your pocket: I have done a Ted X talk that I think you will find interesting. I make the point that sperm have to swim the equivalent of the distance from Los Angeles to Hawaii in order to succeed in fertilizing an egg. Do you know why it takes at least a quarter of a million sperm to make a healthy baby?

Abrami: why?

Davis: It's because they don't know how to ask for directions.

Abrami: I fell for that one.

Davis: When you get these slides on your own computers, you can simulate the exposure. Look at the white in the control slide. That indicates either the nucleus or the border. On the exposed slide, you can see that on some of the cells, the nucleus has been degraded and in many cases, the border is gone. Again, indicating damage to the membrane. So, cellphone radiation damages the membrane of the *brain* as well as the *testes*. I believe the *eye*, as well.

Abrami: I see the Cleveland Clinic quote there. Was this research done there?

Davis: Yes. Some of this research has been done there. Some of it has been done in Australia at their equivalent of the Cleveland Clinic and other work has been done at other clinics. What's interesting is that people doing this research started to do it two decades ago because they were concerned with the number of doctors showing up having fertility problems. What they concluded in a cross sectional analysis was that those who had the most beepers and things on their pelvis had the lowest sperm count.

Recent study glioma on Slide 28: Summary of the most recent work I have done with Prof. Anthony Miller who has himself authored more than 600 publications. It basically shows every study that has looked at people who have regularly used phones for ten years or more, for an hour a day or more we found an increase in *glioma*. More studies have been done now. The most recent study was released this week.

Thyroid Cancer: The American Cancer Society supported a study of thyroid cancer. It was done at Yale University that shows a double risk of thyroid cancer from those using phones that had specific SNPs which are quite common. These SNPs have to do with repair like p53 and other things that have been identified. The newer phones have antenna located closer to the thyroid. The study concludes that they have found a link to an increase in cancer from regular cell phone use. *It was just published this week.*

Effects on children's brains: Slide 31 tells you of the effects on the brains of children are substantial. Here is a study that looked at the brain matter of preschool aged children, using MRI. I don't know how they got approval for this study but they did. They concluded that there was degradation in the brain white matter looking at microstructures with heavier regular screen use, which is further reason why the American Academy of Pediatrics has said we must reduce exposure in young children.

Abrami: They based it on one study or the preponderance of evidence thus far?

Davis: Well, this is one study but it's a replication of many other findings on effects of attention, behavior and learning in children.

Effects on memory in teenagers: Slide 32 looks at teenagers and again they find a deficit in memory of kids. I will let Theodora talk to you about synergies on slide 33 they found in Korea. Mr. Abrami, you had stressed you wanted replication. I am showing you these are all replications of results on adverse effects on learning, behavior and attention from cell phone use in children.

Why so many conflicting studies? Slide 37: The answer is, follow the money. The majority of the studies in this field have been funded by industry or the military. That's just a fact. Analyses of the studies show that 75% of all the negative studies have been funded by industry or the military. Microwave News 2006 assessed *funding bias*. You don't need to be a statistician to know which way the wind blows.

Insurance Industry Slide 39 shows secondary insurance Swiss Re and Lloyds of London and others will not cover damages from wireless devices or EMFs. They rank it in the same category they once ranked asbestos.

Abrami: We were well aware of this fact. Have you spoken to anyone from the insurance industry about this? Why don't they insure?

Davis: Several years ago I did. They run the numbers. They think there is sufficient scientific concern and the 10K reports of wireless industry say they may face liabilities from lawsuits. There are lawsuits right now on behalf of people with brain cancer that are still going through the courts. They have not been thrown out and frankly I think they are going to win.

The last slide is the one of the cartoon. I just want to remind you. It had been very difficult to get people to stop smoking in the environment of children because the science had been deliberately manipulated. Unfortunately, that is what we are dealing with here as well. Why did the FDA reject the NTP? They have not even given a reason.

Sherman: We kept hearing about the need expressed by federal agencies for a comprehensive review of all the studies that have been done and yet that hasn't been done is my understanding. Is there any plan for comprehensive review? If there is, would that review take into account funding sources? We know from several other medical studies that the impact of funding is huge on conclusions and editorial control of final conclusions on the studies.

Davis: Environmental Health Trust, I can say is that we are the mouse that roared. We have managed in the paper that I shared with you, Miller et al. That is the closest thing to a comprehensive analysis. That was done in 2018 two years ago.

Abrami: We have to pause. Beth has to leave. I am thinking about the 14th of Feb for our next meeting.

Cooley: I am not available but I can see if someone internally is.

Davis: What is your schedule for completing your work?

Abrami: We have until October to have our report finalized.

Davis: Your work will be vitally important because there is a huge gap. The federal government has abdicated it's authority for years. We have been really shocked at the appalling situation with the FDA. It just flies in the face of science I have shown you just briefly here. I could have shown you even more on male and female reproduction in animals. I could have shown you more effects on humans. This simply indicates that there is a robust body of scientific evidence, including the study I just showed you that just came out on the thyroid (Luo 2020). That study is putting another nail in this coffin. We know industry knows how to make safer phones. The real question is for 5G, what does all this mean?

Sherman: Can we get a link to that?

Scarato: Yes, and also the bees because they look at MM waves specifically.

Abrami: Yes. We are interested in bees. That is an area we want to pursue.

Davis: I have a video in my slides of the bees. This study was done by bee experts with three hives. What it showed was the hive with phone off and the control hive had no effect. The hive with the phone turned on, those worker bees did not return and they stopped producing honey. Obviously, you are not going to have a phone in a bee hive. But it's clearly indicating a susceptibility to this exposure.

Abrami: This has been very helpful. We are trying to get the facts and understand. Unfortunately, as a commission, we don't have the resources of the federal government here in New Hampshire. We don't get any funding to do anything other than us being here as volunteers. We are going to work as hard as we can to get at the facts. We would like to hear from the FCC somehow or at least a member that was in the room. You suggested that there may be someone that may be willing to chat with us.

Davis: I think he may be willing to do it without being identified by name. It is a tough business.

Abrami: Well, we will take him anonymous.

Davis: I will ask.

Sherman: I can talk to our federal delegation and see if they can twist some arms to get somebody here. This is something Jeanne Shaheen should be able to compel.

Davis: I fully agree by the way .The appalling thing is there isn't any staff member at the FCC now with any training in this field of bio-electromagnetics.

Abrami: I would like to know in their last ruling, what they based their decision on?

Davis: Montgomery County if preparing to file suit against the FCC because in their statement, they confirm the 23 year old standard. They do not show any recognition of the 1900 pages of scientific evidence they received in response to their proposed rules. They asked the question: in advanced notice of proposed rule-making, should we change our standards? They received hundreds of scientific statements including from us stating that they should. In failing to review the 1900 pages, they are violating the Administrative Procedure Act. I don't know if any members of your commission are a lawyer.

Abrami: We have someone from the AG's office on our commission.

Davis: That's wonderful! I would like to talk to the AG and see if the state wants to join this lawsuit as an Amicus. It doesn't cost any money. Montgomery County probably has a budget equal to your state.

Garod: have any other states joined?

Davis: We think California is going to. What I have been told by a reliable source who was at the meeting, was that Ajit Pai said, I don't care about science. This is what we are doing. That is so arrogant.

Sherman: Are the FCC meetings public?

Davis: This one was certainly not.

Abrami: Devra, I will connect you two by email and you guys can have a chat.

Davis: and I will connect the AG person with the AG person in California.

Abrami: well, we will start with you talking to him. We are out of time now. We would appreciate maybe down the road having another conversation with you.

Davis: I am happy to do that. The fact is that the federal government is failing in its duty to protect public health. That's very unfortunate and therefore you guys are in a very important role. You really are. I have been accused of being a closet Republican. The fact is it may take Republicans to do this because the Democrats have been in bed with these guys for a long time. I hope I don't offend anybody.

Abrami: Let me see, about half anyway.

Davis: The fact is both Republicans and Democrats are both well supported by this industry.

Abrami: At the state level we do this on the cheap. We don't get any money.

Davis: I know you are a citizen legislature with real lives and real jobs and you are doing this as well and I am truly grateful to each of you.

Abrami: We are trying to do what we can do and to get the facts. We appreciate your time and Theodora as well. I will connect you with Brandon our Asst. AG. Another other questions:

Woods: how do you know the level of scrutiny the FCC gave to the scientific information provided? You say they didn't look at it. How do you know that and what level of scrutiny did they give it?

Davis: I know that because of a person who was at the table when this happened.

Woods: Ok

Sherman: Is there any reference to the science?

Davis: No. it's as if all of it doesn't exist. Let me be clear, five years ago I brought a number of different scientists who had done this research from Turkey and England to the FCC and met their so called interagency group on RF radiation and briefed them. There is such a group. They have no power. They have no authority. They have no statutory standing to do anything at all except to advise. I don't go into the FCC to brief anyone any more. There is no one to brief. In fairness to the agency, they have huge responsibilities to a lot of different things. This issue is one where yes, you want faster connections to your services. You don't want you fire and police to rely on wireless. It's not reliable. Snow and rain can interfere with it. When you have too many people trying to call, its slow. We cannot afford to have emergency services, public health and the hospitals relying on wireless. It's not safe. We need wired connections and we need to have a major push for fiber optic cable and broadband access to and through the premises.

Abrami: We saw that on 911 in NYC.

Davis: From the point of view of the Dept of Defense, they have issued a report on this warning about the vulnerabilities we face. Demanding wired connections for those that need them is the way to go. I think those in public safety have to reset the conversation. If you are really going to protect public health and safety, you've got to have it wired. It's the only secure connection you can have.

Scarato: I want to add to what Devra was saying about to the two questions about the FCC. How do we know what the FCC did or did not review? There is actually an item the FCC released where they talk about the decisions they made and based on what. As an example, Environmental Health Trust put in countless submissions. We were one of the high submission groups and they didn't address our submissions at all. They addressed some but the large majority of research on biological effects was not addressed in any deep way that one would expect. On the NTP, they just said we are going with what the FDA said. There is a three page paper on what the FDA says and there is only one paragraph on the biological effects. Scientists would expect a more robust document that goes over you gave this study but this scientist thinks this. That wasn't there.

My second question of who is doing a systematic review? The WHO EMF Project which is different than the WHO International Agency for Research on Cancer, there have been a lot of criticisms of transparency on the WHO EMF Project for many reasons of which I have a link to. They have been trying to do a review and it's been mired in questions of transparency. Who are the experts? Who is picking

the experts? Whereas, the International Agency for Research on Cancer, when they did their 211 determination that you are familiar with Class 2B possible, they vet the researchers for ties with industry and I should add that they are now calling for a reevaluation for the carcinogenicity of RF and that should be completed before 2024. That is model systematic review on everything.

Miller: I would argue that the solution that Devra is proposing does not solve the problem at all. Our public safety entities all have fiber to the premises. They don't have access to fiber when they are on the road. So mobility and interoperability are key.

Davis: Let me be clear. There is no 5G for voice. There is probably not going to be 5G for voice for perhaps a decade or more because 5G as you all know is fast and short. It doesn't go very far. In order for you to have 5g on the road, you need to bury it in the highway and people are proposing that by the way. The 3G and 4G that you use now travel miles.

Miller: Are you saying that 5G is the only product or technology that causes radiation?

Davis: No.no.no.

Miller: So, it doesn't matter which generation, 3, 4 or 5. They all cause radiation. I think the mobility factor is very important. So the solution needs to come elsewhere within the design of the devices and not to be taken lightly.

Davis: I completely agree. That's why California issued safety advice about how to use cellphones more safely which your commission should consider. The French government issued a guidance that will take effect in July that said, the abdomen of teenagers and pregnant women should not be exposed to cell phone radiation. That's the French government conclusion. We need to educate the public about how to use cellphones more safely and we need to encourage cellphone designers to do frankly what many of them are already doing to redo the software and the hardware so exposures are much less. There are things that they are doing to do that. Within the industry, there are people I have talked to who say the only problem is the lawyers, no offense again.

If they come out and say now we have got a safer phone and people will say, why didn't you make one before? What about all these people who have tumors in their ears and tumors in their brain and other problems that came from their phone? It's a huge liability problem for them. You are absolutely right. We need safer phones. By the way, our twitter handle is @saferphones.

Abrami: We have had conversations about that in this commission recently as well. This shouldn't be adversarial with industry. We should be shooting for the same goal. Let's make it safer.

Sherman: Devra, two of my close friends were Marianne Donovan and Ron Herberman.

Davis: oh my goodness. Two of my dearest friends.

Sherman: I served on a board with them. But back when Ron was testifying and taking an awful lot of heat for that in Congress, one technology that was available was a very lightweight shielding along the skin side of cellphones to shield from RF from the antennas. Do you know what happened to that? It was low cost and light weight and could have been incorporated into the phone without much difficulty.

Davis: That was a company called Pong but has been renamed. There are cases that have been devised that do reduce the radiation somewhat.

Gee, then you know then what Ron went through. You know what happened to Ron who was such a distinguished scientist. He told me had never experienced anything like that in his professional life.

Sherman: yes, I was there when that happened.

Abrami: Out of respect for everyone's time, we need to go.

IV. Next meeting: February 14th. 8:30-10:30 Agenda to be determined.

V. Meeting Adjourned at 11:00am.

**NH COMMISSION TO STUDY THE ENVIRONMENTAL AND HEALTH EFFECTS
OF EVOLVING 5G TECHNOLOGY**

Meeting held:

2/14/2020

8:30-10:40 am:

LOB 202

Meeting called to order by Rep Abrami at 8:30 am.

In attendance: (10)

Rep. Patrick Abrami-speaker of the house appointee

Rep. Ken Wells- speaker of the house appointee

Kent Chamberlin-UNH-appointed by the chancellor

Denise Ricciardi-public-appointed by the governor

Michele Roberge-DHHS- Commissioner of DHHS appointee (*Augustinus Ong attending for Michelle*)

Dr. Paul Heroux- Professor of Toxicology, McGill University- speaker of the house appointee

Rep. Gary Woods-speaker of the house appointee

Senator Jim Gray-president of the senate appointee

Senator Tom Sherman-president of the senate appointee

Brandon Garod-AG designee, Asst. AG Consumer Protection

Not present: (4)

Frank MacMillan, Jr. MD-NH Medical Society Environmental Medicine

David Juvet-Business and Industry Association

Bethanne Cooley-CTIA , trade association for wireless industry and manufacturers

Carol Miller-NH Business & Economic Affairs Dept.

Agenda:

I. Approval of minutes from 1-10-20:

Abrami: Michelle is not here but we are allowing *Augustinus Ong from the Radiological Health Section of DHHS* to sit in for her.

For us legislators, it's been an interesting past couple of weeks with most of us running non stop. Bethanne Cooley could not be here and we knew about that. I am not sure about Carol Miller. We are allowing Augustinus Ong to sit in for Michelle Roberge from DHHS. With regard to the minutes, Bethanne Cooley sent me a note saying, she was incorrect to say that the San Francisco Right to Know Ordinance was struck down. So I am going to adjust the minutes on page 9/10 and take out those comments. I give her credit, she went back and checked and found she was incorrect. With those corrections, minutes were approved.

II: Denise Ricciardi- Outside call concern:

Ricciardi: I debated about this but I think in the interest of transparency, it is important to mention. I received an email in my personal email which is not the email that I use for this commission, from Dr. George Carlo in Washington. He said that he wanted to speak to me and thought he could be of help to this commission. I called and I was uncomfortable and uneasy with the conversation and I asked him to speak to our commission. He said that he could not do that, that he has to work under the radar. He kept using the word “we” when talking with me and I asked him who is “we”? I asked him how did you get my personal email? Oh, somebody gave it to me.

This went back and forth on the phone and we followed up via email and I used the right email that I use for the commission. He asked, why can't you and some of the delegation come to Washington and talk to me? I said because of Right to Know laws and transparency and I was very uncomfortable. I am not implying anything... for the record. I did research him and do you mind if I just read this?

Public Health Scientist and Epidemiologist, is one of the world's leading experts on Electromagnetic Radiation. But from 1993-1999 Dr. Carlo headed a 28.5 million dollar project funded by the telecommunications industry. It went on to say that he studied cellphone health effects and discovered that the risk of acoustic neuroma, a form of brain tumor was 50% higher in long term use of cell phones and it goes on. I am just putting it into the record for the interest of transparency. I am not implying anything. I just want it to be known.

Abrami: thank you. Are there any questions on that?

Heroux: Most of you are aware of Dr. George Carlo's past involvement?

Abrami: not really.

Heroux: He is an epidemiologist and a lawyer and at one time he was retained by the cellphone industry in wireless technology research to devise a research program that would shed light on the effects of cellphones. After he was recruited by the cellphone industry, it seems that things became very complicated and nebulous so people have various takes on that but he is a very important central character in this whole issue. But, I would say that his motives are a little bit uncertain for many people. So, that is his history but he is a very central character in this issue.

Abrami: Did you ever ask him if he would be willing to speak with us here?

Ricciardi: Oh yes and I have it in email. He says he can't. He has to work under the radar that what he says could be taken out of context. I just felt uncomfortable. I debated if I should address it or not but I think it was the right thing to do in bringing it up. I hope you all agree.

Gray: I just want to remind the commission here that your task is 5G. It isn't 3G. It isn't 4G. Your task as defined in legislation is 5G. If you are going to say other technologies you should relate it to that there could be difference because of mm waves and get it back to the topic. Your task is not 4G or 3G. It's how 5G affects and whether we should do something about 5G.

Abrami: We discovered early on and I didn't realize this when I wrote the bill for this commission, that you can't talk about 5G without talking about 3G and 4G. We broadened it early on in our meetings. It turns out that 5G is this nebulous thing. It depends upon what company you are talking about with 5th generation. Will they use mm waves or not? I understand what you are saying Senator but it seems we cannot talk about 5G without talking about the others.

Gray: Representative, there was the opportunity to put a bill in this term that would have expanded the scope of this but we didn't. I am just trying to do what the law tells me. The law tells me this commission is supposed to look at 5G. What is the health effect of 5G vs 4G? We talk about the size of the wave. We talk about how that can affect and again, a lot of the things we have had as testimonies don't deal with 5G at all. They deal with 4G technology, things that were studied and not using the same size waves that we are talking about in 5G. Again, that is what our task is.

Abrami: If you go back to one of the earliest meetings and review those minutes, I said I believe if there is no objection, I think we have to broaden this a bit. I have been on plenty of commissions that things get broadened as they come up.

Today we are going to get at the towers that are 5G with Paul. We have conversation among us that the technology is hidden in the antenna. So it's very hard for us to understand even that if this is proprietary how much power, the configuration of the antennas and all that so

Ricciardi: It is my understanding that if 5G were to hang in front of everyone's home, that it can't solely work on its own. It would be piggybacked with 4G. If I am correct in that, that's where they come together.

Woods: Two aspects. Number one, looking at 5G is relatively new and research is not as robust but looking at using 2, 3, 4G it's like any other research protocol. You look and say what does that tell us? Then you look at mechanisms and then you say, let's look at 5G. It gives us a basis in which to look at 5G and educates us for parameters that we need to verify. Secondly, we also need to understand what 4G does because we haven't really gotten into synergies yet. Physical systems and biological systems for sure become more complex with synergies. We really haven't but I am sure we will as we go along, talk about synergies. I think those two things are important for us to look at both. I understand the concern and we have to focus more as we go along in terms of decision making.

Gray: The things the good doctor has said is consistent with my statement. If you are going to talk about other technologies, you need to say why 5G is going to be harmful, how it compares to it. Again, don't just throw out a study and say its cellphone technology, so it's bad.

Abrami: I agree. A lot of the testimony we have had is on cellphones themselves. Again, a cellphone is communicating with whatever.

Wells: Just to reiterate something we talked about before. When we talk about electromagnetic radiation, you talk about characterizing it by frequency, energy intensity and polarization. That's really

what we need to talk about whether its brand name is 5G or 4G is immaterial. The characteristics of the waves that we talk about are given by the physical parameters.

Abrami: To me, what we are discussing is all things RF radiation. Our goal is to try to understand this. Where is the line drawn and where or if, are the health effects? We are in contest with FCC and FDA. We are just a little state here but what keeps me going is there is enough compelling research out there saying something that it seems we should pay attention to. Where we end up late summer or early fall, I am not quite sure. We haven't started bringing this together. What can we do as a state? Where are we heading with this? First of all there are a bunch of lawsuits out there right now against the FCC and those things will play out. The other reason for the bill was to get ahead of the curve as a state on all the push back that is going on around the country. I don't know whether that pushback is based on hysteria or not. I don't know. But, there is pushback. Every day I get stuff sent to me like yesterday from Huntington, NY. My brother lives there. I said to him, do you know anything about this? He said not really. Are we straying off the theoretical parameters a little bit? Probably but I think we need to. Is someone going to slap my wrist for doing that? I think you have to, in order to be able to discuss this topic.

Chamberlin: Because 5G is an add-on to 4G, the more we understand about the preceding technologies, the more we are going to understand about the impact of 5G technology. It is really important that we look at the body of information that is out there on previous generations.

Heroux: With 5G, we have no epidemiology and relatively few studies. The other aspect is that there are low, middle and high frequencies for 5G. As Mr. Wheeler of the FCC said, the technology is ill defined. So we don't have a very precise target. They are going to be on common structures. To be well instructed about health impacts, you have to know about EMR as a whole and experience we have is from earlier generations, if we are going to epidemiology information as a goal at all.

Abrami: the studies of 3G and 4G impacts do impact what we are looking at. I appreciate the comments but we have to plow forward. Obviously, in our report we are going to be addressing 5G but if we find out that there are things we should mention in our report related to RF radiation, we should do that. We are going to vote and I mentioned this once before. A House commission is different than a Senate commission. You sign off on a report on a Senate Commission. We don't sign off. Your way of not agreeing with the majority is to write a minority report. That's the way our commissions work.

III. Pat Abrami: Smart Meter Bill:

The next thing on the agenda, is this on topic or not on topic? We have heard some discussion about smart meters. I was minding my own business one day when I overheard the prime sponsor of the smart meter bill. I said we are doing 5G, sign me up. Senator Sherman signed up too. I think the Representatives can understand, sometimes you look at a title and think I could contribute to this bill. Unfortunately, I had not read the bill until just before the hearing a few weeks ago. It turns out that the prime sponsor knew nothing about the topic. He was submitting it for a constituent. NH has a statute on the books about smart meter gateway devices. That was passed eight years ago. It's a pretty strict provision. My understanding of a gateway device is that it gets readings from your

refrigerator and different appliances and that connects to your electric meter. My sense and I am guessing now, is that this was more about security than RF radiation when they passed this bill. We are big on security in legislature. If electric company wants to put one in your home, you have to “opt in” not “opt out”. That’s a tougher climb. You have to sign a piece of paper that says, yes, I want this device in my house. This was almost like a preemptive strike on something that someone was anticipating.

Sherman: I remember the discussion on this. I think one of the problems was if you have a meter that can be read by anybody because it’s transmitted then this was mostly a privacy issue. If your use goes up significantly, that’s your business. I think the big concern was law enforcement being able to tap into this.

Abrami: So it was a totally different angle.

Ricciardi: Do we have a law here in NH about privacy protection because that segways right into the lack of privacy with 5G. I just wonder. Do we have anything in place?

Abrami: I don’t know.

Sherman: I don’t think we have a single law about privacy protection. Even the technology of license plate readers being used by police was blocked in the Legislature. So we don’t allow them to hold onto the license plates after you go through the toll booths. We don’t allow police to go into a parking lot and do license plate scans. I don’t think there is a single bill on privacy but I do know that as bills come through there is a high level of scrutiny on how much personal freedom this might impede.

Ricciardi: That should coincide with 5G then because that is surely a lack of privacy.

Abrami: When I read the literature on preparing because I testified on this bill. There were four issues: One was privacy with the smart meter relaying to electric companies.

Chamberlin: I don’t know if we are talking about the same bill but there is a current bill that came before the House Science, Tech and Energy Committee about 5G smart meters and one of the concerns was health, so they deferred to our commission.

Abrami: Yes. That’s the one. I testified that day. You missed the hearing that day. The bill was filed and what it did was mark up the existing statute basically taking away what we have. I testified in the hearing and said this bill needs to be worked big time. It turns out that there are different degrees of smart meters. There are like three layers of smart meters. Eversource came in and said, wait a minute. We have a truck that drives around and it activates when we want to take a measure that is very low level. It only pulses when it is signaled to pulse. Eversource saying wait a minute, what are you doing to me and you would have to agree with that. Then there’s the electric coop, which is bigger than you think. They have it and they say that theirs only pulses 14 times per day. You can’t really say there are any health affects because it pulses 14 times in a day. The continuous pulse is the third. I think that’s the one related when you read the list about health effects. So

clearly, in your committee there wasn't enough evidence for them to consider so what they did was they asked if our commission could take a look at this. So, if we have time, we will take a look at it. Does it have to do with 5G? I don't know. But its continuous pulsing and people are concerned about continuous pulsing.

Sherman: We actually have a new lawsuit in Rye. A resident is having to leave she said because of the smart meter pulsing from a town building which is actually the school. She is suing the town for cost of having to move to a new location. The concerns are already out there and are affecting municipalities.

Abrami: The big thing especially apartment buildings where all the meters are in one spot, that's the ones that I read are problematic. Supposedly there are ways of shielding that.

Wells: I think we should hear some testimony on that. I am very skeptical that a metal plate is going to do anything except radiate on the other side. A faraday cage will keep the field out but it won't keep it in.

Abrami: We have to bring in the right witness who knows this topic cold with the different types of smart meters. They did the right thing. The bill was not ready to be passed and Science and Tech did not have the time to fix it. They have 50-60 bills I think in their committee. They have a lot. That was the smart meter update.

IV. Dr. Paul Heroux-Cell Tower Placement

Heroux: Essentially, this is about 5G. 5G will have as a primary consequence installation of a lot more towers in our environment. The question is, what do we know about the impact of EMR coming out of towers from the past? I did a short study trying to gather the written literature on this. I have a number of articles that I will leave with you and I have as well an Italian film on the Vatican. What this film does is help us gain historical perspective on how long conflicts relating to the radiation can drag on throughout the years. The situation with the Vatican is still ongoing. They are going on trial for manslaughter. This is something that is very old but persists today.

Essentially, we don't have epidemiological evidence obviously, on the impact of 5G towers because they are very new and sometimes they are not even activated yet. Some of these units can function in one mode or another. The experience we have is from towers of the past. I have assembled some publications. There is a publication here by Michelozzi, 2002 that describes childhood leukemia up to a distance of up to 6km from the powerful Vatican radio transmitter. The Vatican needs to broadcast throughout the world. They have very interesting antenna. They are huge structures that rotate. Of course the intensity of this radiation is very large which is why it seems that the epidemiologists have detected health effects as far as 6km away. This is an extreme area of antenna not representative of cell phone towers that we have in our immediate environment.

Abrami: That's an important point. They are their own little country. Do they have standards?

Heroux: They have standards of radiation that are different than those of Italy. Of course the radiation is coming across the border which is a problem we all have. Radiation from one in multi-family dwellings impacts the neighboring family. This is not an uncommon problem. In the Vatican, you have a very powerful transmitter with a very small population of people affected because it's mostly small cities and countryside around these huge transmitters. But epidemiologists observed very high relative risk.

Abrami: Can you give us a sense though of how intense?

Heroux: It was at the legal limit for Italy.

Chamberlin: These are under 30Mhz aren't they?

Heroux: Yes. There are a number of antenna there and the relative risk was 7 for lymphomas and for non-Hodgkin's lymphoma and leukemia 5 times. So there is very high intensity and very high relative risk of these diseases.

Then Santini in 2002, this is a study that is remarkable in that it documents a number of health effects, not only cancer but other neurological effects. But, it is weak because it was based on questions asked of people, which is always much less reliable in terms of epidemiology. Of course the investigators tried to do the best they can. This is not like the documentation of say a tumor but they said up to 300 meters, they could observe neurological effects from cell towers.

In 2010, Khurana provides a review of 10 base station proximity and neurobehavioral effects and three investigations of cancers. He reports that 8 of the 10 studies report increased prevalence of adverse neuro-behavioral symptoms or cancer in populations living a distance of less than 500 meters from base stations.

Probably the most convincing evidence, I would say is from Dode in Brazil 2011. This is a study that if you read it through, is performed in a way that is very open handed. They used tumor classifications and sub-classifications from the international committees. They used public health records. They had the cooperation of utilities as well as many universities and their documentation is very detailed. So, if one is to be given weight, it should be that one. Essentially, they came to the conclusion that yes, they can document these effects.

What is most striking, is they can also detect that if they install a cell tower near your home, within two years, is when you will get the maximum incidence of cancer. They documented cancer because, unlike neurological symptoms, cancer is not subjective especially when they are quantified by histology and by international classification. This report of a large city in Brazil with a large population which is known to have a public health system that documents. Within 500 meters of a base station and there are many base stations that are documented, you will have increased incidences of cancer. These exposures are much smaller than the FCC limit of course. They have a range of exposures that they measured within the study. I think this, needs to be read.

In 2020, Pearce essentially provides the most recent assessment. Each of these studies of course goes through a bibliography of its own. It promotes, again the 500 meter setback to limit future liabilities of

the cellphone industry. He is talking mostly to the cell phone industry and saying if you want to limit your liability in the future, you should respect the 500 meter distance.

In 2018, I have an article by Affuso which examines the economic impact on home values. If you are within .72 kilometers or 720 meters of the base station, your home value goes down by up to 9.78%. As the NTP studies are more widely known in the population, this is probably going to increase.

We do have studies of high intensity that have documented cancer at long ranges. We have studies over large populations that also confirm the 500 meter danger zone. In other words, your health will not be the same in terms of cancer and neurological impacts if you are within that zone. So when we are considering 5G, we will be considering antennas that apparently will have more powerful output because of this radiation goes less well through oxygen and water. It has focused beams to go through structures to attain people who are hidden. So as a result, exposures will be more transient, more focused and more intense. But we don't have epidemiology on that. We would have to wait 10 or 20 years before we have the information. Sadly, the only information we can rely on is information from the past. I think that anyone should read the study on Belo Horizonte, the third largest city in Brazil will see that this study was done very carefully and in my opinion is very convincing.

Ong: Dr. Heroux, in the Brazil study, was there any comparison between the pediatric incidents and the types of pediatric cancers before installation of these towers and comparison of those rates and incidents after these installations?

Heroux: I believe that all the cancers were classified according to international standards so some of these classifications are specific to pediatric but the control were regions that had no cell towers that were investigated at the same time.

Ong: But you mentioned earlier that the Belo Horizonte have very good cancer registry. So for the same region, you will have the same data prior to the installation of towers vs. the rates after installation.

Heroux: I believe their data covers approximately ten years. I believe that they used the reports within those ten years and discriminated between those near cell towers and those that were not.

Abrami: Well, what I think he is trying to say is, are there other reasons for this higher rate of cancer and filter out the other effects that may cause it. I understand what you are trying to say.

Heroux: I guess you would have to read the study to satisfy yourself about these details.

Sherman: Getting at one of Senator Gray's concern, to fully understand. This study was done with presumably 3G and 4G towers. Is that right?

Heroux: Yes. Those are similar to ones that you would see here.

Sherman: One of the things that you mentioned was that the peak cancer effect was within two years. So we wouldn't have to wait twenty years to know. If we used this as a springboard for what is

happening with 5G, it would be interesting to do a study in a city that has already implemented 5G then you might be able to do the before and after registry.

Heroux: Yes, ideally but the wheels of government and science turn rather slowly in a sense. This was done in 2010 but this technology is about 10-15 years old already...before you get the agreements between the number of universities and public health systems and so on and so forth. But they have a record of when the antenna was installed and when the cancer occurred which allows them to come up with this statistic.

Abrami: This is the thing that has been nagging me about the small cell tower. We just don't know. That is the whole premise of this. We just don't know and how do we get at that? Clearly, there is not money supporting research.

Gray: Part of what we are hearing is that if there is a 500 meter limit then the amount of radiation is very important in to the rates of cancer. I am accepting your data at face value okay? Now, we look at 5g technology. We have smaller towers. We have less power. So that 500 meters may be 275 feet. You talk about being able to submit a minority report. If I was to try to do the peer reviews about all the different things that people have presented to this, I would be talking about billions of dollars. I go back to 1960's when I was watching 60 Minutes talking about the EMR coming off high power lines going through the Midwest affecting the cattle that we eat and we are all going to die because of it, okay? Again, I am just trying to get you to stay on topic and the 500 meters... yes. There may be a component in there that the amount of radiation nearness to it, you said 30 Mhz and below and 5G starts at 30Ghz and above...all of these things affect what we are supposed to be looking at and the results we are going to get. The one study that we were given that they talked about it wasn't fair to do whole body radiation on a particular animal because that would have a much more devastating effect and all you have to do is find one cell within that whole body that would react.

Abrami: we are not there yet. We are still working on this.

Sherman: We have had a lot of scientists around this table. I think nobody is pretending to come to any conclusions at this point. But in science and in healthcare, we try to look at all available data which is what we are doing. Some is going to be historical data that comes from other RF sources. I think it's perfectly reasonable to look at other RF sources especially since those aren't going away. 5G isn't coming in and replacing all of this as far as I understand it. 5G is coming in on top of 3G and 4G. So, I think it would be a little bizarre for us to look at 5G in a vacuum without the understanding of the current environment and the data on the current environment. I think with a cautionary tale that I hear coming from Senator Gray is that doesn't necessarily mean that we can extrapolate data from 3 and 4G and say that this is going to be the impact of 5G. Study commissions go where the data takes them and I think we are doing that. I haven't heard of anybody coming to any conclusions yet. I think we are still looking at data.

Ricciardi: I just wanted to mention that I believe I forwarded Rep. Abrami information on a town in the Netherlands that put in the 5G, the town became rapidly ill. I can go back and find that. That is 5G and that is evidence on human beings. And that is on topic.

Chamberlin: That was a small study as I recall.

Ricciardi: Yes. They put it in and very shortly after the whole area became very ill.

Chamberlin: True. But somebody could claim that maybe it was a water problem as well. I am interested in following up on that.... particularly, in places like South Korea where they have installed on a larger scale. We need to keep our finger on the pulse there. If you find any more of those, forward them to the rest of us.

Heroux: Can I have one last remark? Essentially, the tower question of course takes care of the general environment but in relation to the new phones which will also have this and possibly more radiation from these phones. The phones could be altered in a very simple way to simplify things for users in terms of health impacts and even perhaps for industry. These cellphones are immensely useful. But one of the problems is that when we hold them close to our body, they tend to over expose us to radiation. There is all this controversy around the proper SAR. They can put 5 cameras and 10 antennas in the most recent phones.

What you can do is put a proximity detector in a phone so that when it comes near to your body, it doesn't work and doesn't radiate any more. This would mean that you could use your phone exactly as before but the risk of overexposure of the phone would be severely reduced, in my opinion. You would cut out all the extreme radiation putting it in your bra, your pants near your genitals or near your head. This is something that is not done right now but technically it is far from impossible. It's relatively easy to put in a distance detector and you would be instructed by your phone to expose yourself less. I think from the point of view of industry that if it is told by government to do that, they don't incur any more liability. If they do this on their own, their lawyers will tell them...hmmm.. you are admitting to something that may not exist. This is a problem. But if it's imposed on them, you are solving a problem for them as well.

V. General Discussion:

Abrami: Thank you. So I have amassed a list of potential speakers. I have reached out to most, but not all of them yet. If there is no comment on the paper, it means I have not talked to them yet either by phone or by email. Dr. Carpenter we will hear from in a minute. Dr. Martha Herbert can do something in April or May. Dr. Sharon Goldberg has been in conversation with Michelle. You can read through the list. I wanted to talk to Hardell because he is the former WHO fellow who is retired that was involved in this whole thing. Kelting is retired and will be our speaker next month. Dr. James Lin, I am really interested in. He is an electrical engineer but his appointment is in a medical school. He has published a lot in IEEE. I talked to him the other day and told him he could do it by phone. He doesn't like to do it that way and wanted to know if we could pay for his travel. I said, well, you don't understand. This is New Hampshire. We don't have a budget! So he is thinking about it. I have not contacted everyone yet.

Dr. Chamberlin, I was going to talk to you if you have any need to have a fellow electrical engineer come in for any kind of seminar series, maybe we could tie it to that.

Chamberlin: I will check into that.

Abrami: I think this guy is worthwhile having. I have checked some of his papers. They are very technical papers that he presents. I know that there are some others names that aren't on this list that people are suggesting to me. I am going to warn you Senator, that Carpenter may be a little broad so bear with us. He is aware of some legal actions in NY State. I know it would be great and I am trying to get more focused on the technical. With this group, I think we know what the issues are. We understand the science here.

We can start the discussion about the next meeting. March 6th won't work because Dr. Sherman, Sen. Gray, and I are on the Seacoast Cancer Cluster Commission together that day. Beth told me that she cannot make the 13th. On the 20th, Senator Sherman will be out of town.

Gray: On the 6th, you could do an afternoon meeting because the Cancer Cluster meeting will be over.

Sherman: I have a Seabrook working group on the opioid crisis so I can't be here.

Abrami: We could do the 20th. Out of fairness, I want to make sure we have Beth at the table.

Garod: I have a jury trial the week before that. There is a possibility it may not be over.

Abrami: Brandon, did you ever connect with Theo or whoever?

Garod: After you sent the email, I responded to her but have not heard back. I encouraged her to reach out to me.

Ricciardi: So, you did reach out to Theodora? Ok.

VI. Dr. David Carpenter-University of Albany "What is 5G and what do we know about the health effects of 5G?"

Abrami: David, welcome. You are in our meeting. We have someone who will move the slides for you. Please introduce yourself.

Carpenter: I am David Carpenter. I have two titles here at the University of Albany part of the SUNY system. I direct the Institute for Health and the Environment which is an interdisciplinary research institute that is a collaborating center for the World Health Organization. I am also the Professor of Environmental Health Sciences and the former Dean of the School of Public Health. I have been involved in issues related to electromagnetic fields for a long time. I first came to NY as the director for the state health Wadsworth laboratories. Two weeks before I arrived in New York, there was a settlement between the state Public Service Commission and the State Power Authority asking the question was there an elevation in cancer risk by high voltage power lines? As a new guy on the block, I was given the responsibility of administering that program. We had 15 research projects funded by state utilities. At the end of that project, we did find elevations in childhood leukemia in children living

exposed to high magnetic fields. I became the spokesperson for New York State on that issue. Once you touch a controversial issue like this, you never escape. It's never been my personal research but I have been involved in this and published extensively on it. I have been on national and international committees.

Abrami: What did NY State do about that?

Carpenter: Effectively nothing. They did establish a standard for the magnetic field for the edge of Right of Ways. But they determined that standard by measuring the magnetic field at the edge of Right of Ways and the standard was the highest one there so there wouldn't be any new magnetic fields greater than those that were existing. This is really one of the problems with RF fields. We are all so dependent on things like electricity and communication frequencies and nobody wants to restrict use of it and hopefully not make it worse than it presently is. It's very difficult to restrict use.

Electromagnetic Spectrum:

Let's go to the second slide, the electromagnetic spectrum. The form of EMR that most people know is visible light. At higher levels than that, we have the ionizing portion of the spectrum that includes x-rays and gamma rays and these have enough energy to directly damage DNA, cause cancer and birth defects and that sort of thing. Below the visible light, we have infrared radiation which is heat from the sun. Without that, life on Earth would not be possible. Below the infrared, we have the communications frequencies. It is important to note that the 5G that is being proposed is just below the infrared. It's Gigahertz frequency. The electromagnetic spectrum is all packets of energy with different frequencies. The higher the frequency, the more energy it contains. But the frequency is important. At the left of the slide, the extremely low frequency that's the magnetic fields associated with electricity that I was originally involved in.

Radiofrequency (RF) EMFs:

The point is that these radio frequency EMFs are communication frequencies, everything from radio to television to cell phones to radar. This exposure has increased enormously in the last number of years. Now we have Wi-Fi everywhere. We have smart meters put on many of our homes. These are meters that use RF waves to transmit your use to the utility. In the future, there are going to be ZigBee drives in your refrigerator, dishwasher and every appliance and it's going to communicate your electricity use to your smart meter. That's going to make the kitchen and laundry room particularly hotbeds of exposure. Driverless automobiles will use RF fields to see the car ahead and will enormously increase exposure to these things. The microwave oven uses RF fields and most of these frequencies are in the microwave range. Clearly, if you can cook your potato with a microwave, there is potential harm from exposure. But most government agencies, certainly the Federal Communications Commission (FCC) has the position (which I think is wrong) that there is no hazard from microwave exposure if it is at an intensity that is not sufficient to cause tissue heating.

RF in the Ambient Environment:

It used to be that RF environment was really radio and television. In the past few years we have increased the RF in the ambient environment enormously and with the imminent rollout of 5G there is going to be a great increase in human exposure. One punchline is that 5G has not been studied. It has not been around long enough and we don't have any population of humans that have been exposed so that we can determine whether it's really dangerous or not. We do know a lot about our existing 3G and 4G. As these generations develop, they go to higher and higher frequencies. Our cellphones, Wi-Fi, smart meter are all 3G and 4G frequencies. What does this sudden increase in RF exposure suggest regarding human health?

Health Risks to Humans from Existing RF:

We know very well that extensive use of a cellphone held to your head increases the risk of cancer. Gliomas particularly, less so other forms of brain cancer, and particularly glioblastoma which is a very malignant form of cancer. This is the cancer that killed Ted Kennedy, Beau Biden, John McCain, the lawyer in the OJ Simpson case. I am not saying that it was definitely cell phone use that caused all their cancer but these are people who undoubtedly used cell phones a lot. The cancers only occur on the side of the head that people use the cellphones most of the time. In addition to the glio cancers, there is a Schwannoma tumor of the auditory nerve that we see commonly called acoustic neuroma. It's not a cancer but a tumor that grows in the bony cavity in the ear and causes problems. There are some elevations in cancer of the parotid gland on the cheek and the thyroid gland. It seems likely that excessive exposure to RFR at non thermal intensities increases the risk of a variety of cancers and what is really critical is which part of the body is exposed.

National Toxicology Report/Ramazzini Intitute Study/Other:

Now the International Agency for Research on Cancer (IARC) which is part of the World Health Organization (WHO) has rated communication frequencies as possible human carcinogens. This was a number of years ago and one of the reasons why it wasn't a stronger reading in that there hadn't been clear evidence that cellphone frequencies cause cancer in animals.

National Toxicology Program (NTP) which is part of the National Institute of Health (NIH), just last year came out with the results of a two year study. It demonstrated that rats exposed to cellphone frequencies develop schwannomas of the heart.

Abrami: Just so you know, we have talked to those folks.

Carpenter: Ok. Let's go on. The Ramazzini Institute did a similar study but at much lower intensities. They found exactly the same thing. We now have good animal evidence in addition to human evidence. There are other health effects that are well documented, particularly reduction in sperm counts and infertility in men from abnormal sperm and some evidence of spontaneous abortion and premature birth in women with excessive exposures. There is some evidence for cognitive alteration in children, if

they are on their cellphone too long. It's difficult to understand if it's a direct effect of the radiation or because kids aren't sleeping because they are talking all night.

Then there is the very controversial but pretty clearly real problem with Electro-hypersensitivity. Some people, by no means all become the best way to say it is "allergic" to the RF fields. They develop headaches, nausea, vomiting, and a sense that the brain isn't working properly. Sometimes they have heart palpitations and a general feeling of ill health. This has been seen in adults and now fairly frequently in children in school environments where there is intense Wi-Fi, much more controversial than brain cancer.

Emerging wireless technologies:

5G (5th generation cellular technology) as I have said, is RF but at a higher frequency that we have at 3G or 4G. It's being promoted widely just about everywhere. This is the whole concern of the Trump administration with Huawei the Chinese company. The idea is that 5G when fully developed is going to just change the way that life on Earth is done. It's going to be the Internet of Things, Smart Appliances, Smart Cities, certainly self-driving vehicles and wearable devices. A lot of hype about this and a lot of sense that somebody is going to make a pile of money and that this is going to be good for communication at the much faster rate than we have currently with 3G/4G. The 5G frequencies will be in the Ghz range which is higher than current 3G/4G which are lower than 1Ghz, in the MHz range. Ultimately, the 5G can be up to 70 Ghz which is almost at the frequency of infrared radiation. It will be 100x faster than 4G, potentially add new jobs and a lot of economic growth. It's a higher speed greater capacity.

Limitations of 5G:

The problems with 5G are several. Because it's at much higher frequency, the waves do not penetrate as far as the 3G/4G waves do. They are easily blocked, even by weather. The radiation will not penetrate a building. It will not go through glass and won't travel so far. This is a real problem so as 5G is being implemented around the country and world, instead of the cell towers that have ranges of over 2,000km, the 5G will require mini cell towers to be placed in front of every 6-8 houses in urban areas. The 5G will only have a range of 20—150 meters not kilometers. That means that as these are placed everywhere, you are not going to be able to walk down a side walk anywhere without being continuously exposed. Now if you are in your house, since the beam won't penetrate the house, that's probably a good thing. Now one of the real problems however, as we are rolling out 5G, our current infrastructure is 3G and 4G. These mini cell towers places all along the street are not just going to be exclusively 5G, they are going to be 3G and 4G as well. While we haven't really studied health effects of 5G, I have already told you of health effects of 3G and 4G. This is going increase the exposure to 3G/4G dramatically. These mini cell towers are going to be everywhere. That is a real problem totally independent of the question what are the hazards of 5G.

Abrami: We have talked about these things in our commission. We are trying to get at what is in those towers. It's really about the power. Let me ask you though, the issue with the small towers is you get every company with different strategies of 5G. Can you discuss that a little bit?

Carpenter: Well, I am not an expert on that. I know that each company has their own power also they don't share their information very much. It is very difficult to get that information. They really don't want the other companies to know what they are doing. I can't really answer that question. But I do know that all of the ones being implemented right now are not exclusively 5G. I think the expectation is probably pretty good that 5G is not as dangerous as 4G. That's because 5G is not likely to penetrate the brain. It's not likely to cause brain cancer because it's going to be blocked by the skin. Now that raises a whole series of other questions. What is going to be the effect on the skin? Is there going to be an increase in skin cancer? Is there going to be alteration of sweat glands? We don't really know that answer. Again, my big concern is the greater exposure to the 4G frequencies which we know to be hazardous in extreme exposure.

Abrami: This is the discussion that we are having. The towers are lower to the ground. They are right in front of your house. There are science issues and all that but there are emotional and aesthetic issues that people are pushing back on. Our understanding is that it is less power and we are trying to grapple with how much damage compared to a large cell tower.

Carpenter: In the large cell tower, there have been studies showing increase in leukemia in people who live close to the large cell towers. But the large cell towers direct the beam at the horizon. That's for the purpose of having a reception over a very long distance. These small cell towers close to the ground are going to have beams directed right at everybody. It's going to dramatically increase exposure relative to that you would get from a large cell tower.

Abrami: It's the $1/R^2$ rule right? The closer you are to the tower....

Carpenter: that's right. The question is ...whether the beam is directed or if it's like a radio transmission tower which is 360 degrees. Our current cell towers have a focus beam at the horizon. For some reason, people living very close to a cell tower probably get less exposure than people living some distance away where the beam then sort of spreads down. These mini cell towers on a lamp post or wherever they are on the street are going to be very close to the ground level and it's going to be impossible not to have elevated exposure.

Abrami: Usually with cell towers, there is a radius around and there is nothing there. There are plenty of studies showing the fire station concerns but these small cell towers are going to be right on the street and low to the ground.

Carpenter: yes. I was actually in California for the Fire people opposed to towers on every fire station just for that reason and they did block that plan.

Sherman: On these small cell towers that will have 5G and 4G, is it a lower power 4G since there are going to be more and they are going to be closer and there is not going to be the same need to shoot at the horizon? Or is it the same power as the big towers?

Carpenter: I don't actually know the answer to that question. I suspect it's going to be a lower power. But, I don't actually have good knowledge of that.

Abrami: Let's keep going.

Carpenter: The issue is there is no real research on 5G. There are a few animal studies now. Again like any new technology, there are people making outrageous claims for hazard and others that make outrageous claims for safety. So, I think we just don't know. But the issue of cancer from RFR, that is very strong. The issue of effects especially on male fertility is very strong. The Electro-sensitivities are certainly going to increase as people are exposed more.

Carpenter: Is there anything uniquely bad about 5G? I think the answer is no, other than the fact that the way it's being implemented is going to increase exposure.

Who is protecting us?

The FCC has no health expertise. I visited them several years ago trying to push them to at least have some cautions in their recommendations. They basically said, we don't have any health expertise, we depend on other agencies for that. Then they don't have any other government agencies that are pushing them. I am actually a plaintiff in a legal case against the FCC for their standard, which says that there are no adverse health effects except those caused by tissue heating. That simply is not true.

Abrami: Can we pause on that for a second? Which suit is that? There are several out there now.

Carpenter: Well this is all fairly recent. Bobby Kennedy is the lead attorney on this suit. But there are several out there. It's really sort of outrageous that the Federal Communications Act of 1996 specifically prohibits placement of any cell tower based on concerns of health. This is a real problem for many localities and states because this is federal law. You can object for other reasons but not for health concerns.

How Strong is the Evidence of Harm?

The evidence is very strong for 3G and 4G, especially for cancer and effects on male fertility. It is less strong on some of the other things but certainly enough evidence to merit concern.

There are so many sources of RF and the average rate of exposure to RF has increased over time. Since 2003, there has been an enormous increase as we have gone to just about wireless everything. The latency for many of these health effects, especially cancer is going to be long. We know from ionizing radiation that the latency is 20-30 years. One big concern is we roll out all these new sources of exposure, what is going to be the long term impact? We are seeing an increase in glioblastoma risk in the US and around the world. Not so much in other brain cancers. Actually, some of the other brain cancer rates are going down. But, there is reason to be concerned.

The conclusion is with 5G, you can download your movies faster. There may be other benefits. It is not obvious to me what the other benefits may be to the individual, maybe to business, maybe to government but it's just that we are rolling out 5G very rapidly without any good information as to whether the risk might exceed the benefit.

Abrami: Well, thank you on this. Let's talk about NYS. That is where you are based. Are you aware of anything going on legislatively in New York? I thought I read that they may be thinking about forming a commission like ours.

Carpenter: They haven't gotten past that. It's being rolled out across the state and there are a number of legal actions. There have been a couple of meetings in the state assembly on the issue, but no significant legislation has passed. There is a growing concern. It's interesting, one of the Vice President's here at the University of Albany, asked me to give a talk for a public group and he knew nothing about the issue until they put a mini tower in front of his house. That seems to be happening around the state. Little information, if any and then the mini towers are placed and implemented and that gets people pretty concerned. There is a fair bit of angst among the population but only the population where it's being put out otherwise there is very little information.

Abrami: I just received something about Huntington, Long Island. I had seen this before, a public hearing in their town council. For five years they have been complaining to the town officials and they are very concerned because these small cell towers are going up in their community and a lot of people are pushing back. We are seeing this across the country.

Carpenter: Sure. It's really across the world. I am being taken to Australia to talk about 5G this summer.

Abrami: We just heard that Switzerland put a hold on 5G until they understand the science a little better.

Carpenter: Yes. I think one of the concerns is that there seems to be absolutely no benefit to the ordinary individual maybe to business and industry. Other than the fact that you might be able to download a movie more rapidly, what's the benefit?

Abrami: one of the things that I saw was autonomous vehicles but it turns out that the industry is not going in that direction with the little towers along the road. It's going to be built into the cars.

Carpenter: It's going to be built into the cars and likely to be lower frequency.

Ricciardi: I just wanted to clear up a question I have or make sure I understand it correctly. Although our commission is tasked with the health effects of 5G, what I understand and correct me if I am wrong, because it will actually be placed approximately every few homes and because it cannot work independently and has to work with 3 and 4G, what's going to happen is whether we know much about 5G or not, the fact of the matter is everyone is going to be living under a cell phone tower and being exposed to radiation continuously which can heat tissues over time. Is that correct, Dr. Carpenter?

Carpenter: Well, the last part I think probably is not correct. If you have low intensity to these, there may be a level of heating that can't be measured but you would be constantly exposed but there would not be any measurable increase in temperature. That's the debate with the FCC because there is this enormous amount of information showing health effects at non thermal levels. But, I don't think because you are continuously exposed at a low intensity that there would be a measurable increase in temperature.

Ricciardi: Okay, but you would be exposed continuously which would potentially precipitate other health effects.

Carpenter: That's correct. I am sorry I probably should have prepared a more technical presentation. I didn't realize that you were so well informed on this. We have a pretty good idea what the mechanism of these damages is. The primary mechanism is that non thermal levels of RFR generate Reactive Oxygen Species (ROS), commonly known as free radicals. If you remember in the NTP study, they demonstrated direct DNA damage in those rats and these were clearly non thermal intensities.

There are many nasty things that generate ROS. In fact, our body generates them just as part of the normal metabolism. We also have a whole series of enzymes in our body that are there to protect us against them. Very clear evidence that non thermal levels of RFR cause the generation of these ROS. If you are exposed continuously, then you have a continuous generation of those ROS. You don't need the temperature rise, to cause harm. The ROS can damage proteins, lipids, carbohydrates and DNA. The evidence is quite strong that this a common mechanism that then leads to a whole variety of other changes. For example, changes in brain metabolism and blood flow to the brain and whole variety of things. There is a good body of evidence that allows us understand how you might get damaged from continuous exposure to RFR at levels that don't raise body temperature.

Sherman: Just a quick question. What you are describing is the epigenetic impact of non-thermal RF levels. You are actually changing the DNA. Do you know of any evidence of people who are more predisposed like family history like genetic makeup? In other words, is there anything in your genetic makeup that would predispose you to increased risk of being within an RF field?

Carpenter: I don't know of any real study on RF fields. There is a very interesting study on the magnetic fields from power lines. There is a study on electricity from China I believe that did look for different genetic traits in children that developed leukemia from being near power lines and children exposed who didn't develop leukemia. They did find there is a genetic susceptibility factor there. I would be quite surprised if that weren't also the case with RF but I am not aware of anyone that has really studied it.

Wells: On one of your slides, you talked about current 3G/4G cell towers having a range of 2,000 km. I just wanted to check on that because my interest is not just on the transmitter power but the power over the area and what that means in terms of the intensity in watts per square meter to which people will be exposed. So, 2,000 km is the correct figure for 4G?

Carpenter: Well, yes. That's the correct figure. Of course not every cell tower has intensity that goes that far. For example, in most urban areas you don't have that intensity. But in rural areas and so forth, you have a higher intensity. That's also true when you use your cellphone. If you are a long way from the tower, your cellphone automatically increases the intensity of the signal it sends back to the cell tower. That 2,000 km is sort of the upper limit of a cell tower.

Wells: If I can just follow up on that. You talk about 5G only penetrating skin. I was wondering if you would comment on current SARs on Watts/kg versus intensities of watts/square meter. Which do you think is the more appropriate way of looking at exposure?

Carpenter: well, certainly with 5G watts/square meter is more appropriate metric because we have no reason to believe 5G is going to penetrate beyond the skin. The 5G is actually being used a little for crowd control. If you have sufficient intensity with 5G, of course you have tissue heating. You can direct a beam at someone who is trying to escape the police.

Abrami: Rep. Wells is all over that one!

Chamberlin: So, I have a question about the strength of the evidence that exists. Since getting on this commission I have been reading a lot of papers and I find that there are lots and lots of papers out there. You can't deny that there is a risk of harm. It's also somewhat overwhelming, the number of papers that exist. Have there been attempts to bring that all together to these meta studies that you mention? Where can I get access to them with high statistical confidence that a problem does exist?

Carpenter: That's a good question and it's a complicated one. The place where most of the evidence is put together is in the BioInitiative Report. I was the co-editor of that. But that report was criticized by just about every national and international body, as being selective. In fact, it was not selective but we have not had effectively any government agency with real credibility and that's true around the world acknowledge the strength of the evidence that I think see and I think that you see. The problem is, first of all you have a powerful industry that doesn't want their product tarred as being dangerous. Secondly, we are all so happy with the benefits that come from modern technology that we don't want to hear that it's potentially harmful. I am frankly baffled by the antagonism that the Bioinitiative Report has received. It was criticized as not being peer reviewed. Well, the original report wasn't peer reviewed but almost everything in it was published separately in peer reviewed scientific journals and passed review. But it remains a very controversial subject.

Abrami: Can you send us that report? The chair has been corrected. We already have it.

Carpenter: It was originally published in 2007 and updated in 2012. There have been some additional updates in 2014. It's huge and much more than anybody ever wanted to know and I think the individual chapters on specific subjects. I think there is something like 3 or 4 thousand references in the report.

Abrami: Are you the prime author on this?

Carpenter: No. I was a co- editor. I had the major role in writing the public health chapter. But each of the chapters was written by other people and actually Cindy Sage was my co- editor and was the power behind it but I had a major role in identifying who would write chapters and so forth.

Chamberlin: As a follow up question, can you give us the sense of relative risk? Is the relative risk something like 1.2 or something like 10? And do these have associated low e values?

Carpenter: Well, I am involved in all kinds of hazard investigations. My major research actually is PCBs and dioxin and pesticides. Some of my colleagues wouldn't agree with me but I don't think the relative risk here is anywhere near as it comes from things like smoking and chemicals that are toxic but one has to be careful about this because again, our exposure has increased so dramatically so recently. We have evidence in links to cancer but in latency being long, what's going to happen twenty years from now? You can look back at smoking and you can look back at PCBs and DDT and these things in the 60's and 70's were thought to be quite harmless. Now we know they increase the risk of all kinds of diseases. That's why that last slide I mentioned the Precautionary Principle. At the moment I don't see that the relative risk comes anywhere near the risk we have of other kinds of exposures but I am not sure that it's not going to be viewed as much greater in the future. If you put a mini cell tower in front of every 8th house, in every street in the US, who knows what the outcome is going to be in 20-30 years? The cancers that we see are relatively rare. But they are also fatal when you get them.

Sherman: Dr. Carpenter, I am also a physician. I am a state senator here in NH. I sense some frustration in your voice. One of the issues that we have been grappling with which is what Rep Abrami talked about is PFAS how it's in our drinking water. But the similarities between both of these is that we have very powerful and well- funded industry that is basically dismissing all science that is raising alarms in both of these areas and one of the big concerns that I have is that well- funded would not be a good description of the NH legislature and certainly not the people who are pushing back against industry. You are in an academic setting and you are doing some really good work on this. Do you have any suggestions on how we can lift up the Precautionary Principle before everything is installed and in place and we have to wait 10-20 years to know that we have just done in an entire generation? Do you have any models or any communities that you worked with that have been able to mitigate the influence that some of these companies so we are not regretting down the road that we did not provide at least some precautions as we move into this new era of RF exposure?

Carpenter: well, I certainly work with a number of communities that are trying to do that but I can't say that it's been very successful. The big barrier here is the 1996 Federal Telecommunications Act. There have been some communities where industry has sort of backed off hoping that the angst will go away but in others, the telecommunications companies has basically taken legal action on the basis of the Federal Communications act saying we have the right to put these in and you have no right to object to it.

I think what I would really like to see is that provision in the Telecommunication act being invalidated. It is outrageous that communities and states are prohibited by that regulation from opposing this kind of development. We don't have that similar kind of thing with chemicals like PFAS and PFOA. This is a very strange situation where we are prohibited from protecting the health of the public. You can debate how hazardous this is but it should not be up to industry just doing anything it wants to and public and other forms of government having no ability to block it.

Abrami: Let's go back to the Kennedy case. What are the two sides on this? Is it the FCC?

Carpenter: The case is that the FCC by virtue of having this philosophy that there are no harmful effects other than those caused from tissue heating is causing severe harm to the US population. The plaintiffs are a public health person and a mother of a child that died of a brain tumor. There are a couple of people that have Electro-hypersensitivity. The goal of the suit is to get the FCC to tighten the standard of exposure for RFR.

Abrami: we are probably the most lax of most countries, right?

Carpenter: Oh yes, by far. There are other countries that are equally as lax but we are way more tolerant of exposures than others. The Russians have had the lowest standards for the last fifty years. Now, I don't know that they reinforce it that much. Our standards are just ridiculously high.

Abrami: What court is this going to?

Carpenter: I don't know. It's directed to a federal court but I am not clear where it's going to go yet. This has all happened in the past couple of weeks. There are other suits pending too.

Abrami: The Environmental Health Trust that we head from a month ago. They have a suit as well against the FCC. As a commission, we want to talk to the FCC and also where they get their guidance. If the FCC says well, we listen to the FDA and FDA is saying there is no problem, I think that's part of the suit the EHT is involved in. But IEEE is setting standards, right?

Carpenter: Engineers and electricians setting standards for health is pretty ludicrous.

Abrami: We would love to talk to someone from the FCC but that is proving to be a bit of a problem and the FDA. EHT said what we should do is write a letter to the FCC with questions and the same thing to the FDA with questions. They have been known to respond. I think we need to do that. If we can't bring in a human being to testify, we can at least say we tried to elicit comments from the FCC. What I am suggesting to everyone here, send me your questions. I will sort through them and we can talk about it for the next meeting.

Carpenter: I think that is a very good plan.

Abrami: If you have any questions, send them to me, too. Someone in the back of the room would like to talk.

Public speaker: I have one quick question. For all the doctors in the room, I recently saw a video with Dr. Lena Pu who had done a blood test on a teacher who was in a classroom with Wi-Fi and the blood test indicated after a day of exposure that the viscosity and quality of her blood had basically coagulated like it was cooked. Would it be simple to do a study on people who say for a week have not been exposed to any cellphone, Wi-Fi, television and do the blood test and then test again after exposure? I am wondering if there are any other parameters besides cancer that should be looked at. I think blood quality is pretty important and leads to all kinds of other stuff.

Abrami: I thank you for your comment. We have been trying to explore the different research that is out there. Does anybody recall anything on blood?

Heroux: Yes. The rouleaux formation is very well known. Even short term tests can show if you expose blood to EMR and you have some but even if you show that to the FCC, they will say...so what?? This will dissipate after some amount of time and the mechanism for that is probably that you have free mitochondria in the blood actually. It's very new data. You have a lot of mitochondria floating freely in the blood and they help the red blood cells to coagulate together. There is plenty of that kind of evidence. What does it mean for the people in that class? If no one is willing to take that step, we are wasting our time.

Abrami: In the classroom situation, we are talking about routers everywhere. One of the people who testified for us when we got the bill passed was Cece Doucette who years ago was involved in getting wireless technology into the school until she realized, what have I done? Now she is working to try to undo some of it and have safer technology. There is no reason schools need these routers. They can be hardwired for instance.

Carpenter: With hard wire, there is no exposure whatsoever.

Abrami: And actually speeds are better.

Sherman: Speeds and reliability.

Sherman: Do you know any blood impacts Dr. Carpenter?

Carpenter: There are colleagues in Paris that have done some very good work on measuring some things in the blood that are markers of people that are electro-sensitive. They focus mostly on this electro-sensitivity. Again, all the markers they are finding are related to these Reactive Oxygen Species (ROS). Dominic Belpomme in Paris is the one who has done that. We have published with him and I can send you the article with that information and I would be happy to do that.

Woods: We already know that blood can be temperature sensitive. There's cryoglobulin anemia in people where if you put an ice cube on their skin, they get hives. This is a known entity and it's not everybody. Again, it's a genetic variation. But it bespeaks a broader picture in fact that a lot of the studies at least to my eye have been bulk tissue or bulk material investigations. What we are wrestling with now is getting down to the molecular level instead of bulk tissue, we need to look at cellular and molecular levels and that's what we are hearing here and what we have been surmising where we need to go. We don't have a lot of these good molecular studies although we know mechanisms clearly can take place already, like you mentioned the mitochondria and we have talked about other issues before that get away from what the IEEE looked at and getting down to the molecular level. We are trying to make that transition.

Sherman: I have one question. We are mainly interested in human health impacts but we have heard some rather frightening studies on environmental impacts. Can you comment on those Dr. Carpenter if you have any expertise or knowledge about environmental impacts, specifically of 5G but since this is going to be ubiquitous, the concern is this is also going to be 3G/4G... bees, insects, plants. Any thoughts?

Carpenter: Well, there is some evidence for effects on bees for example, some concern that the demise of the honey bee may be related to the RFR distorting their ability to find their way back to the hive. Again, that evidence is somewhat weak. There is a tendency whenever there is a health problem, whether its bees or humans, everybody has got their favorite villain to blame. I don't think that the effect on honey bees is very strong. On the other hand, the suggestion that hives that are placed near cell towers lose their population of bees relatively quickly. I had a high school student do a project with me last summer. She was looking at the effects of cellphone radiation on the growth of plants. She used wheat seed and had an active cellphone by one plot and an inactive by another. The active cellphone resulted in poor growth of the wheat. So, there is some evidence but again it's not 100%. Again, I agree the concern should be human health. Unlike many of the toxins that we have studied, I think we have stronger evidence for human hazard than we do for plants, bees and animals. It should be humans we care about. That's why I emphasize human research.

Abrami: There aren't research dollars coming this way.

Carpenter: They are not coming this way. They are not there at all. Again, that is the influence of the industry.

Ricciardi: I just want to comment. Knowing whether we know all we need to know about 5G or not, it disturbs me that we know it is going to work with 4G. We already know what that can do and living near a tower can do. They roll out 5G in the state of New Hampshire and it is going to be in front of our homes. Essentially, they are forcing our residents to live under a cell phone tower. I don't understand that. We know 4G is not safe and they are going to hang together in front of people's homes.

Carpenter: That is exactly right.

Sherman: And there is nothing you can do about it.

Ricciardi: This is the "Live Free or Die" state here. Now that you are putting something in front of my home that may make me ill, I am sorry, I just had to put that out there.

Abrami: Well, we can do what we can do as a state but there are laws that trump others. The 1996 law, that's the real issue.

Ricciardi: Well we are certain that 4G will do harm. Whether 5G does or doesn't they will be hanging together in front of my house. That's my point.

Abrami: There is evidence. Yes. There is frustration with the current state of affairs. As a commission, I think we are all more educated on it than three or four months ago. Dr. Carpenter, I really appreciate, the dialogue was great. Thank you. If you send us that one article, that would be good.

Carpenter: Alright. I will do that right away.

Sherman: thank you so much.

Carpenter: My pleasure and I really appreciate the fact that your commission is looking into this.

Abrami: Ok. Thank you. That was a good summary and it sounds like we keep coming back to the same thing. We know what the issues are and I would really appreciate any comments or questions please send to me via email on the FCC and the FDA.

Sherman: For my part and this is not a part of the commission but I will reach out to our federal delegation on the clauses in the FCC law. I don't see any reason why health effects should not be part of, it doesn't matter what political party you are from. If there is a health impact or potential health impact, it should be part of the decision of whether you can roll out new technology.

Abrami: Well, politically they figured it out if there were health effects, it would slow the whole thing down. That is the political reality of what happened and here we are. I have been in meetings on just regular cell towers in my town and know how hard it is to get just a regular cell tower up. People are up in arms about that, let alone be in front of their house. Verizon was getting very upset with our town as it took three or four locations before they said okay since they were concerned we would be sued by Verizon. So, the last location, they said okay. This is where it is going to go, despite upset residents in nearby areas. I was in these meetings and the neighbors were arguing health effects even with 4G towers. They said no, can't talk about that. That's just the reality.

Sherman: One of the things that he said that struck me was essentially the further you are from the source, the higher the energy that is going to be generated by your phone so while we worry about Rye has the same issue. We can't seem to get a cell tower. We have spotty cell service all along the seacoast. Does that mean that our cellphones are maxing out with our local exposure? Could the fact that you don't have a cell tower nearby and have to have a more powerful transmission from your phone increase your risk more than having a cell tower closer?

Gray: I can comment on that part. There is a decrease risk from radiation that comes from here. There is an increased risk of the radiation that comes from the cell tower antenna. You are closer to the antenna, you are getting more radiation. But with this, the power level of the phone goes down.

Sherman: That is what I am saying.

Abrami: I think we have concluded that from our meetings is that's the reality, the your cellphone works harder, the further away the tower is, it's really working hard to make a connection and is continuously trying to make that connection and will wear your battery out quicker too.

Wells: I was wondering if we could take a look at that FCC act of 1996, The Federal Telecommunications Act. If it's about cell tower placement with respect to health effects, there may be another way of addressing this.

Abrami: Section 704. We will have it for the next meeting.

Heroux: It was interpreted in the courts as meaning "health" but the wording is "environmental" that they use in the act itself.

Abrami: so the court interpreted the words.

Heroux: Yes. It's an interpretation.

Ricciardi: There was an incident in Bayville Elementary School in New York. You can research it. They put the tower near the school and after five years, 30% of the students and teachers got different cancers and three of the children died. They had a lawyer, I can't think of his name but you can google it. They went to court over it and they definitely conclusively showed that it came from that tower but because of that Telecommunications Act of 1996, nothing could be done about it.

Heroux: So the mechanism by which this occurred is very simple. In Washington, industry lobbied the government elected officials for a uniform law that would implement prosperity, essentially. But they confused communication with wireless and the deregulation of the industry when the breakup of AT&T happened, made it very profitable to promote wireless vs. optical fiber. Essentially, those are all unintended consequences that happened historically.

Abrami: there have been arguments from other speakers we have had here that on your phone bill, they have been deducting money for wired communications (landlines) but that money has been diverted to wireless.

Abrami: I will see everyone on the 20th. We won't see Senator Sherman.

Sherman: I will be here in spirit.

Ricciardi: Dr. Sherman so you will be getting someone to move forward with the FDA or FCC?

Sherman: yes, that gives me two things to talk about with our delegation. I will do both.

Ricciardi: Ok. Thank you.

VII. Next meeting: March 20,2020 8:30-10:30

Meeting Adjourned at 10:40 am.

**NH COMMISSION TO STUDY THE ENVIRONMENTAL AND HEALTH EFFECTS
OF EVOLVING 5G TECHNOLOGY**

Meeting held:

7/1/20

1:00-3:00 pm EST

Via Zoom (<https://unh.zoom.us/j/98794338097>)

Via telephone-US (+1 646 876 9923) ID: 987 9433 8097

In attendance: (11)

Rep. Patrick Abrami-speaker of the house appointee

Rep. Ken Wells- speaker of the house appointee

Kent Chamberlin-UNH-appointed by the chancellor

Denise Ricciardi-public-appointed by the governor

Michele Roberge-DHHS- Commissioner of DHHS appointee

Dr. Paul Heroux- Professor of Toxicology, McGill University- speaker of the house appointee

Rep. Gary Woods-speaker of the house appointee

Senator Jim Gray-president of the senate appointee

Senator Tom Sherman-president of the senate appointee

Brandon Garod-AG designee, Asst. AG Consumer Protection

Bethanne Cooley-CTIA , trade association for wireless industry and manufacturers

Not present: (3)

Frank MacMillan, Jr. MD-NH Medical Society Environmental Medicine

David Juvet-Business and Industry Association

Carol Miller-NH Business & Economic Affairs Dept.

Meeting called to order by Rep Abrami at 1:01 pm

Abrami: To respect everybody's time, I am going to start the meeting. This is the Commission to Study the Environmental and Health effects of evolving 5G technology. This is the first time we are meeting via Zoom. We have had a hiatus of about 4.5 months. The last meeting was February 14th. The State House has been closed for many months and we finally got the green light to proceed via Zoom. We are using Zoom, courtesy of University of New Hampshire through Kent Chamberlin who is the Chair of Electrical and Computer Engineering Dept. Kent will go over some technical things then I will read a paragraph about why we are doing it via zoom and not in person. Kent, I will turn it over to you.

Chamberlin: This is very brief. I am assuming most of you are pretty familiar with using Zoom. In your upper right corner, you have speaker view or gallery view. You can play around with that if you want to only see the speaker or the whole gallery. You may want to play with that. You won't hurt anything. Also, if you are not speaking, please mute yourself. You will see the mute indicator on the lower left. If you wish to speak, you can unmute yourself or push the space bar, say what you are going to say and when you let up on the space bar, you will be muted again. It's a good idea if we all mute ourselves so we have no background noise. Also, if you are dropped or have any problem, you can always rejoin the session. That's really all I wanted to say on how to use Zoom. Anybody have any other comments on how we might best use zoom?

Abrami: Kent, we wanted to save the gallery squares for our members, our guest, Joel and Deb. How do we do that?

Chamberlin: If you go to a block that only has a name on it and you right click, it should give you an option to only show those who have their video turned on. This will reduce the clutter on your screen. Is that working for people?

Anderson: I think there are several members who have their video turned off, Senator Gray and Senator Sherman and Brandon Garod. So they may disappear off the screen as well. You won't see their names. Just be aware of that.

Abrami: Ok. We will go with that. I have to read a public statement now:

As chair of the Commission studying Environmental and Health Effects of evolving 5G technology, I find that due to the state of emergency called by the Governor as a result of the Covid 19 pandemic in accordance with the Governor's emergency order number 12 pursuant to executive order 2020-04, this public body is authorized to meet electronically. Please note that there is no physical location to observe and listen contemporaneously to this meeting which was authorized pursuant to the Governor's emergency order. However, in accordance with the order, I am confirming that we are providing public access to the meeting via telephone and other public access via video means. We previously gave notice to the public of the necessary information for accessing the meeting, including how do I access the meeting via Zoom and via telephone. This information was printed in the House Calendar and Senate Calendars.

Welcome everybody to the meeting. Most of our meeting is going to be hearing the presentation from Dr. Herman Kelting, who has been so gracious to be flexible in his calendar. I reached out to him about four months ago. He was going to be our next guest when we stopped doing our meetings because of the virus. We will be following along his syllabus he sent to us. Before we hear from him, we have to review the minutes of the last meeting which was February 14th.

I.Approval of minutes from 2-14-20:

Dr. Chamberlin gave me two corrections this morning. One on Page 5- one quote Dr. Chamberlin feels was from Dr. Sherman. "I don't know if we are talking about the same bill"....

Sherman: As long as it's not inflammatory, I am happy to take credit.

Abrami: Also, on page 19, the last line Dr. Chamberlin said " low e values should be low p values". Without objection, we will make those changes. Are there any other changes that people noticed from those minutes? If not, instead of taking a vote, I will say without objection, we will approve the minutes as changed. Ok with everybody? We are all set. The minutes are approved with those changes.

II: Direction during the final months: We lost four and a half months and we need to discuss where we go moving forward. I think this is going to be the last presentation on the science. In reviewing Dr. Kelting's syllabus, it is a good refresher. There's a lot of good stuff in there that will get us going again from the science standpoint. Most of us are in agreement, not all of us, that the FCC needs to look at the biological effects. We have been trying to reach out to the FCC and FDA with no luck on this. With that said, it's hard for us as a state government to change the FCC's mind on anything. But that does not mean that we shouldn't focus on certain guidance for our cities and towns on the actions that they can legally take to help mitigate any potential harm. I think that's where we need to spend the next four months on looking at what is reasonable guidance that we can give. What really highlights this for me is that about a month ago: Deb Hodgdon, who takes our minutes and me, who are both from the same town were asked by our Planner to attend a zoom kind of meeting with our Planning Board. All the meeting was really was to give the Planning Board an update on what's coming down the pike on 5G. The two takeaways I got from that meeting are that most planning boards have no idea what 5G is and they have no idea of any of the issues surrounding it. I thought we were just going to be observers in the meeting but they asked me to give an update on 5G. They were very interested in what we had to say. The other takeaway is that they are very interested in what we come up with as a Commission for guidance. They are looking for some guidance as a town. We know that there is pushback in other towns and other towns are doing things. I think we need to formulate what is reasonable and what can help with this issue.

Denise Ricciardi who is on our Commission, is on the Board Leadership in the town of Bedford. They have recently adopted ordinances that Denise was instrumental in drafting. We don't have time today to talk about those. I have done research on what other towns around the country have done and there are a variety of actions being taken. Whether they hold up to a legal standard is another discussion. But towns and communities are trying to at least put some parameters around 5G. We should be looking at those examples and working our way through to what we think is reasonable.

Now, understand as I have said over and over again, as a Commission in New Hampshire, we are going to have differences of opinion among us as Commissioners. The way this is handled from the House is that there can be a Majority Report and there can be a Minority Report. That's the way we handle these things. We only have four months. Denise and I chatted earlier about, is there any way we can get an extension? There really aren't many commissions that have reactivated since the shutdown. I will ask leadership in the House whether we can get an extension. The problem we have is that it crosses over into a whole new Legislature and we may be able to do something next year to continue our work. But I think we have to assume our goal is still to have a report out by November 1st. If we think we still need more time, we could see if we could get legislation passed but that will have to be the beginning of next year.

Because there are a lot of us, what I would like to do is to form a subcommittee to start putting some meat around the bone of ideas. Then present that to the full Commission for discussion. I think that is probably the more efficient way of proceeding. I will be looking for volunteers of those willing to work on that subcommittee. If you volunteer to be on the subcommittee, we will probably have to meet once a week for an hour or two and I don't want to wait any longer than a month for the next Commission

meeting. Because we lost 4.5 months, I can't see any other way to do this efficiently with the time we have left. If everybody wants to be on it and is willing to work every week on it, that's one thing but I don't want to have to ask everyone to do that. Tom?

Sherman: I think it's a great idea, Pat. I unfortunately, cannot be on it because I am chairing a subcommittee for the drinking water/groundwater Commission. It's a great way to get this done as long as it's representative and as long as all of us have ample time for feedback and input. Getting something down as a framework for a report and allowing feedback and discussion as a full group is a great way to do this.

Abrami: Well, the way I have done it in the past is there will be a lot of introductory stuff and all that but there will be sections of the report. I am really looking at the recommendations section that we really need to focus on. I don't want to put people on the spot here. I will just ask you to drop me a note if you want to be on the subcommittee. Denise already volunteered and I think Kent may want to be involved. Any others that want to help, that would be great. If I don't think we have enough, I may be reaching out to you and asking again if that's ok.

III. Next Commission Meeting:

Everybody pull out your calendars. Let's talk about the Next Commission meeting now. How about the 27th?

Sherman: Patrick, I work on Mondays. We usually meet on Fridays.

Abrami: Can everybody do Friday, the 24th? I think we are good for our next Commission meeting to be on Friday July 24th at 9 am via Zoom.

Ricciardi: Mr. Chairman, could I just bring something up for the record? All things being fair and equal, our information is important. As you know, I wrote explicit questions with your permission to the FDA and the FCC and still waiting for a response. At some point if we don't hear back, those are invaluable to making these very important decisions that I think those questions should be put in the record.

Abrami: Ok. Without objection, does everyone agree we should put those questions asked of the FCC and the FDA into the minutes of this meeting? Does anybody object to that? Ok so with that, we will put the record of those questions asked of the FCC and FDA into this meetings minutes.

Ricciardi: thank you.

Abrami: I will share with you those questions after this meeting. By the way, we have been having a problem getting things out the way we should. Because of the virus, the staff has not been as accessible as they should to distribute things or post on our webpage. I am trying to be in catchup mode on the things I thought were sent out but haven't been. So I am working on that. I apologize for that.

With that said, most of our meetings we have had, we have tried to get our arms around the science. We have a group that understands the science to a good degree. Dr. Kelting has put together a

presentation with 13 objections. When I looked at it, objections 7-11 are really at the heart of what we want to talk about more. He can start a little earlier and go a little longer if need be because there is a lot of material here. Dr. Kelting has been looking at this issue for many years and has published on this issue and we welcome him. After his sections, we will pause for questions.

IV. Herman Kelting, PhD presentation *(For more details, please refer to presentation materials)*

“I am grateful that you have invited me to testify on the safety of 5G/4G Small Cell Antennas placed in residential and commercial areas which I. I object to 5G/4G SCAs based upon adverse health results. In my testimony I will discuss the attributes of 5G/4G SCAs and 13 objections related there to; time will permit me to discuss only a few research citations. Since 5G is new and has only limited historical application even in 5G/4G SCAs, and 4G and prior generations well established, my research evidence will emphasize the link between 4G and prior generations RFFR with injury to living organisms. I will also discuss 4G emissions in the context of cell phone, Wi-Fi, macro cell phone base stations, etc. because 5G/4G SCAs add to already high levels of 4G emissions from many other sources. As a general rule, I oppose air-borne, wireless emissions.”

Attributes of 5G/4G that I will use in my objections to 5G/4G.

- A. Two sets of antennas in a “5G/4G SCA”: One beam forming on-demand 5G antenna and three 4G antennas, the latter pulsating 24/7 RFFR sited at about every 100 meters in residential neighborhoods. Movement of 5G source (e.g., cell phone) transfers signal to 4G antenna. Hence, I have concluded that the purpose of 5G is not to get 5G into residential neighborhoods but to bring 4G into neighborhoods to satisfy increased demand and revenue. *SCA wireless emissions may be avoided by **hard wiring from street to homes.***
- B. 4G signals are being increasingly modulated, thereby more biologically active, and potentially more harmful to living organisms. [Oram Miller]
 - 1. Marginal harms to fetuses and young children are very severe from 4G/5G and all other wireless communications with thin skulls, over adults who are also harmed.
 - 2. All RFFR is a stimulant causing anxiety, depression, stress, and many other illnesses. Its radiation places a forced on charged particle on our bodies, namely electrons.
 - 3. **Remember this: All manufacturing processes fail in the sense they operate outside the engineering design:** 5G/4G antennas may mal-function to create very high-power densities and frequencies injuring those nearby, who will not know the extent of the damage because they do not have meters. Even if one can prove harm with a meter, damages are limited to the company’s equity because insurance companies do not insure injury from RFFR.
- C. Power densities of SCAs have not been publicly disclosed. Oram Miller indicates power densities from 5G/4G SCAs may be up to several hundred thousand $\mu\text{W}/\text{m}^2$.

Objection #1: 28 Illnesses/ 20 Symptoms known to be caused by or inferentially linked to RFFR.

[Letter from Herman Kelting to the secretaries of Health and Human Services and Homeland Security; original letter dated October 3, 2019; Revision 1 dated January 8, 2019; Exhibit C Herman Kelting. "United States Congressional Research and Legislative Proposals to Educate the American People About the Power Density Safety of Wireless Communications (uW/m²)."
Indian Journal of Applied Research 8(1) (January 2018): p. 263-271 (hereinafter "IJAR Jan 2018").

- A. There are twenty-eight (28) illnesses known to be caused by RFFR. These include increased risk of brain damage to fetuses, miscarriages, cancer. children's behavioral difficulties, ADHD, cancer of the brain, salivary gland, and breasts; leukemia, anxiety, depression, stress, sleep disturbances, reduction in melatonin, cataracts, inflammation; damage to the testes, sperm, blood brain barrier, DNA (damage through strand breaks), eyes, heart, thyroid hormones, electromagnetic hypersensitivity (EMH), damage to the autoimmune system,¹ etc. [IJAR Jan 2018, p. 264-265] If a woman places her cellphone in her bra for five years, there is about a 1.0 chance of developing breast cancer.
- B. There are also twenty (20) symptoms reported by those living near 4G MCPBS (three 4G antennas housed within 5G/4G SCAs) and earlier generations. These include sleep disturbances, headache, depression, fatigue, dysesthesia (pain, itchy, burning from nerve damage associated with neurological injury), concentration dysfunction, memory changes, dizziness, irritability, anxiety, nausea, EEG changes, paranoid states, adverse neurobehavioral symptoms, etc. [IJAR Jan 2018, p. 264]
- C. Nine Determinants of Injury from Wireless Devices: This is a compilation that I have done on the subject.
 1. Distance from the RFFR-emitting device to a body organ. Since emissions from a device spread out with distance, the closer a body organ is to the emitting device, the greater the percentage of emissions hitting the body—if a cell phone is placed at the ear vs. using speaker phone many inches away, a much higher percentage of total emission hit the brain, salivary gland, and other nearby organs. The brain is obviously the most vulnerable to injury. Storage of a cell phone in the bra for five years has an approximate 100% chance of resulting in breast cancer. 500 meters minimum distance from MCPBS to humans and should be 1,000 meters for a two safety multiple.
 2. Frequency modulation: RFFR signals (e.g., cell phones) utilize a high-frequency carrier wave that is transmitted over long distanced with an attached modulated, lower frequency that carries information. The modulation may utilize frequency or amplitude modulation. Signal modulation is an extraordinarily complex technical process that may cause injury to living organisms.
 3. Peak (not average) power density of pulsed radiation transmitted to the body. Power density is the far field (after joining of source magnetic and electric fields) measure of RFFR strength measured by $\mu\text{W}/\text{m}^2$ (micro watts per square meter). RFFR professionals have concluded that it is pulsating peak power densities that create the most harm to

living organisms; RFFR meters have options to measure instantaneous, maximum (peak), and average maximum (peak) RFFR.

Peak densities vary widely based upon the nature of the RFFR-emitting device and signal strength. I measured the far field of one cell phone at boot up of $500,000 \mu\text{W}/\text{m}^2$, which can exceed $20,000 \mu\text{W}/\text{m}^2$ in normal operation depending upon signal strength and other factors.

4. Spatial RFFR density from multiple sources. The spatial RFFR density is a measure of pulsating radiation density from multiple pulsed RFFR devices such as cell phones, Wi-Fi, cordless phones, wireless security systems, etc. in an enclosed space. It is distinguishable from the metered power density *per se* because it is a function of the number of RFFR emitters in an enclosure (e.g., Wi-Fi plus 25 cell phones in a classroom)
5. Meters understate harm from multiple nearby RFFR emitters. As the number of emitting sources in an enclosure increases, the spatial density increases, but the power density may increase little because of the random combinations of peak instantaneous power densities from individual sources. To the best of my knowledge no one else has discussed understatement of power densities from multiple nearby RFFR emitters.
6. RFFR source enclosed in material space- vs. outdoors-sourced RFFR. RFFR sourced within an enclosure (autos, busses, aircraft, trains, elevators, drywall enclosures; metal is the worst enclosure) reflects off the confining material surfaces making equal RFFRs more harmful indoors than outdoors.
7. Age at first exposure to RFFR. Fetuses have thin, incomplete skulls with six separated bones and RFFR will make direct, almost unimpeded contact with their brain through the six thinner skull bones and cranial sutures between bones, which continue to age two. Thereafter, children have thinner skulls for several years, and continue to receive more RFFR than adults. The most dangerous situation is exposing a fetus or small child to RFFR in a metal enclosure such as a car or crawling around a Wi-Fi-sourced RFFR.

“Children whose mothers used cell phones during pregnancy had 25% more emotional problems, 35% more hyperactivity, 49% more conduct problems, and 34% more peer problems.” [BioInitiative 2012, Section 1 “Summary for the Public 2014 Supplement, Evidence for Fetal and Neonatal Effects,” citing Divan et. al. 2008]

8. Cumulative life-time exposure to RFFR. It is not age linear because younger people suffer more than older people because of brain structure and skull structure.
9. Unique cellular and organ attributes and receptivity to RFFR. Each person has different cellular and organ compositions and, thereby, different receptivity to RFFR contamination.

Objection #2: Evidence of mental illnesses of college and high school students.

- A. 25% of college students and 20% of high school students (2018) are claiming mental disabilities caused by anxiety, stress, and depression to take longer course and SAT testing times and private testing rooms because they cannot tolerate the presence of others. [IJAR Jan 2018, Exhibit G: Douglas Belkin. "Colleges Give the Disabled More Leeway." *Wall Street Journal* 05.25.2018, A3; Exhibit H: Douglas Belkin and Tawnell Hobbs. "More K-12 Students Get Special Help." *Wall Street Journal*. 07.05.2018, A4.] It is known that anxiety, stress, and depression are caused by RFFR and from this knowledge I deduced my inference that these mental disabilities are caused by cell phones and other RFFR emitting sources.
- B. College student depression rates increased from 30.9% in Fall 2013 to 39.3% in Fall 2017 ("Felt so depressed that it was difficult to function.") [IJAR Jan 2018. Exhibit E: *National College Health Assessment Survey*, p. 14]. It is known that RFFR causes depression.

Objection #3: Increases in suicides of young people

- A. Actual suicides for 10 to 14-year age group declined from 242 in 1999 to 180 in 2007 and increased to 517 in 2017 = **11.1% Geometric mean (GM) increase** for ten years ending in 2017. [IJAR Jan 2018, Exhibit F]
- B. Actual suicides for 15-24-year age group declined from 4316 in 2004 to 4140 in 2007 and then increased to 6252 in 2017 = **4.2% GM annual increase** for ten years ending in 2017. [IJAR Jan 2018, Exhibit F]
- C. College students who "Seriously considered suicide" increased from 6.0% in Fall 2010 to 12.1% in Fall 2017 [IJAR Jan 2018. Exhibit E: *National College Health Assessment 2017*, p.14; IJAR Jan 2018, p. 266;] "Seriously considered suicides" doubled in 7 years: **10.5% GM annual increase in "Seriously considered suicides"**.
- D. Notice the similarity in IRR growth rates of 11.1% GM actual suicides for 10-14-year age group and 10.5% GM for college students "Seriously considered suicide."
- E. In my opinion, there is a near 100% chance the increase in actual and contemplation of suicides are caused by RFFR from cell phones, Wi-Fi, MCPBS, and are additional measures of a catastrophic health crisis NOW.
- F. One medical doctor told me this: "Doctors know that cell phones cause suicide."
- G. **In my opinion, there is a catastrophic health crisis NOW that is being concealed.**
 - 1. Reported anxiety, depression, stress, and suicides to Secretaries of Health and Human Services and Homeland Security in original letter dated October 3, 2018.
 - 2. Secretary referred my charge to National Institute of Health immediately.
 - 3. NIH rejected three days later and stated "no notice to sender."
 - 4. HK reported NIH rejection of catastrophic health crisis to federal law enforcement agency as an improper rejection of a catastrophic health crisis.
- H. On May 27, 2020, HK accessed the CDC website for precise reference for the suicide data in Exhibit F and was unable to find it after a 45-minute search. Then called CDC and telephone responder looked for 45 minutes and could not find it. The WSJ has had a number of articles on suicides and it appears to me that the historical suicide data for 1999 to 2016 has been removed from the CDC website.

I made a number of predictions in my published article. I am just going to the last one. Some of the others have already come true of course. The last one is that working lives will decline from the mid- sixties to the mid- fifties as people have more exposure to cell phones and radio frequencies. If that occurs, that is going to pretty much be a terrible situation in an economic sense for the United States because of the additional time for retirement payments plus the loss of the skills.

Objection #4: Species extinction from 5G/4G SCAs/RFFR [Letter from Herman Kelting to Mayor Katrina Foley, Costa Mesa, CA. dated January 24, 2020 opposing 5G; HK presentation to Costa Mesa City Council February 18, 2020]

- A. Barry Trower: Physicist and well-known UK 5G weapons expert, who was associated with 5G weapon systems used to injure Catholics in Northern Ireland stated:
1. Installation of 5G/4G SCAs will result in only one child in eight births being born normal three generations (60 years) from date of 5G/4G SCAs installation.
 2. He also indicated that the RFFR injures 4,500 electrical subsystems in the human body by placing a force on charged particles.
- B. Evidence of species extinction in five generations or less is supported by the following scientific studies and other evidence: (ten supporting references follow but I will only refer to a few because of time.)

1. A Greek study of the reproduction of rodent births exposed to RFFR resulted in "...mice exposed to 0.168 nW/cm² (1,680 μW/m²) became sterile after **five** generations, while those exposed to 1.053 nW/cm² (10,530 μW/m²) became sterile after only **three** generations." [A Balmori, 194] "A progressive decrease in the number of newborns per dam was observed, which ended in irreversible infertility" [Magras IN, Xenos, TD. "Radiation Induced Changes in the Prenatal Development of Mice." *Bioelectromagnetics* 18 (6) (1997): Abstract, 455-461 cited in A Balmori. "Electromagnetic Pollution from Phone Masts." *Effects on Wildlife.* *Pathophysiology* 16 (2009): 191-199, 194] (Foley 01.24.2020)
2. Study of 361 men in fertility clinic had reduced sperm count, motility, (moving property through the female reproductive tract), viability, and normal morphology (size and shape of sperm under microscope, >14% normal) as daily cell phone usage increased from zero, < 2 hours/day, 2-4 hours daily, and to >4 hours daily usage [IJAR Jan 2018, Ref 47, Agarwal, 2008]. When you follow these decreases through multiple generations you have the end of species. That is a 55% decline with an increase in cell phone use from 0-4 hours/day.

CP Group	Sperm Usage	Count	Motility	Viability	WHO Morphology
					% Normal
A	No use	85.89	67.80	71.77	40.32
B	< 2 H/D	69.03	64.57	68.21	31.24
C	2-4 H/D	58.87	54.72	57.95	21.36
D	> 4 H/D	50.30	44.81	47.61	18.40

3. Experiment showed that the reproductive capacity of the insect *Drosophila Melanogaster* declined 36.4% (1 min), 42.5% (6 min), 49.2% (11 min), 56.1% (16 min), and 63.0% (21 minutes) exposure to a GSM 900 MHz carrier frequency and 217 Hz information frequency with exposure at a power density of 100,000 $\mu\text{W}/\text{m}^2$ (10 $\mu\text{W}/\text{cm}^2$). Again, this power density of 100,000 $\mu\text{W}/\text{m}^2$ is far less than the 6,000,000 to 10,000,000 $\mu\text{W}/\text{m}^2$ FCC MPE safe limits. This experiment showed the important relationship between time of exposure to RFFR and injury to a living organism. [Panagipoulos DJ et.al. "The Effect of Exposure Duration on the Biological Activity of Mobile Telephony Radiation." *Mutation Research* 699 (2010): 17:22.²
4. Cell phones operating at 900 MHz were placed in three colonies of honeybees and turned on for 10 minutes for ten days. After ten days the worker bees never returned to the three test hives because the cell phones were "...frying the navigational skills of honey bees and preventing them from returning back to their hives." Production of eggs by the queens was reduced from 350 to 100 eggs/day. The authors concluded that cell phone RFFR is a better explanation of Colony Collapse Disorder than any other theory. [Sainudeen Sahib S. "Impact of mobile phones on the density of honeybees." *Journal of Public Administration and Policy Research* 3(4) (Apr 2011): 131-133.] (Sisolac 08.29.2019, 13-14)

There are others listed in my presentation but I think this is adequate for proof.

- C. Doctors and scientists opposing 5G/4G SCAs (*There are others, but here is one*)

Baden Wurttemberg, Germany October 23, 2019

Seventy (70) doctors in Baden Wurttemberg signed and 25 doctors in white coats delivered the letter, "Doctors Warn Against 5G Mobile Communications" to the prime minister on October 23, 2019 asking for a moratorium on 5G small cell antennas because of harm to living organisms. They expressed particular concern with "electro hypersensitivity (EHS)" which now affects 5-10 percent of their population. One doctor-signatory in Baden Wurttemberg stated **"To protect the population, we need Wi-Fi free schools and a 5G moratorium!"** *In my opinion, we also need control over macro cell base stations.*

- D. Many communities have stopped 5G or will not be producing it.

Haifa, Israel banned Wi-Fi in schools April 20, 2016

On April 20, 2016, Haifa, Israel banned Wi-Fi in schools because of the increase in EHS/EMH and because many children were contemplating suicide. It is known that Jenny Fry, a UK teenager, committed suicide because of Wi-Fi in her school.

E. HK request for medical school research from a friend at (Stanford University) dated May 18, 2020 9:50 AM

Does RFFR make Covid-19 more virulent? Asked for Covid-19 (1) free of and (2) attached to host cells to be placed under an electron microscope with a variable frequency/variable power density RFFR to determine if the virus is more active under RFFR bombardment similar to neurons being more active in an RFFR field What gave me this idea is that we know that six CA firemen receiving brain and neurological injury from macro cell base station on the roofs of their fire stations resulting in permanent excitement of brain neurons. (high was outputting between 10-20,000 $\mu\text{W}/\text{m}^2$)

Abrami: Herman, can we pause right here and see if there are any questions at this point. I think what Herman is doing is adding to the list of papers and things that we have already heard about and discussed in the past. He is highlighting some of the papers that are of interest to him. Any questions or comments?

Chamberlin: I just have a question and it involves the bee study. We heard about the bee study and saw the paper on it. This is of course, very convincing. If you put a cellphone in a beehive and it's going to destroy the navigation abilities of the bees now that would be convincing. We are looking for strong evidence. It kind of surprises me that this is a fairly simple study to do. Do you know if it's been replicated?

Kelting: To the best of my knowledge, yes. In other words, there are other studies that have also shown damage to bees with the application of radio frequency. What I have done in my work is pick the best study available and I do not do exhaustive searches with additional support.

Chamberlin: Alright. Thank you.

Wells: I have a question as well. On objection 1, you list illnesses known to be caused by or linked to radio frequencies and I am wondering, could these antennas be used or hacked to cause deliberate injury in your opinion?

Kelting; yes, certainly. Remember, 5G is a beam form signal and that means when you turn on your cell phone, there is a beam that envelopes your body about ten degrees wide and if they combine that with facial recognition, they can do anything that they wish. They can change the power of the beam because that's what they did to the Catholics in Northern Ireland. It's not exactly the same because they can use higher frequencies but they can beam form and take out people with facial recognition in the antenna system.

Abrami: We know in China, they are using facial recognition with their 5G. There are plenty of reports showing that. Is that what you are hearing Herman?

Kelting: That sounds sensible but I am not totally familiar.

Abrami: Let's continue.

Objection #5: Injury specifically from 5G

- A. "Preliminary observations showed that MMM [millimeter waves > 30 GHz] increase the skin temperature, alter gene expression, promote cellular proliferation and synthesis of proteins linked with oxidative stress, inflammatory and metabolic processes, could generate ocular damages, affect neuro-muscular dynamics...available findings seem sufficient to demonstrate the existence of biomedical effects..." [Di Caula A. "Towards 5G Communication Systems: Are There Health Implications?" *International Journal of Hygiene and Environmental Health* 221(3) (Apr 22, 2018): 367-375
- B. 5G transmits data in a very short time period, but there are indications that "...these bursts may lead to short temperature spikes in the skin of exposed people." Research has also shown that peak to average temperature ratios "...may lead to permanent tissue damage after even short exposures highlighting the importance of revisiting existing exposure guidelines." This means that current heat standards are too high and should be lowered. [Neufeld E and N Kuster. "Systematic Derivation of Safety Limits for Timer-Varying 5G Radio frequency Exposure Based on Analytical Models and Thermal Dose." *Health Physics* Sept 21, 2018.] [Letter from Herman Kelting to Nevada Governor Steve Sisolac, Nevada Senator Nicole Cannizzaro, and Nevada Assemblywoman Shay Backus dated August 29, 2019 (Revision 02), 11-12].
- C. 5G operates at the same frequencies (e.g. greater than 24 GHz) as the sweat duct, which is a helical antenna operating at a high specific absorption rate in extremely high frequency bands. This suggests 5G will heat the skin, one of the adverse consequences of 5G.
- D. In an e-mail dated May 27, 2020 2:05 PM , Professor Joel Moskowitz stated "**My note:** This review summarizes research on the effects of millimeter waves (>30 GHz) on the skin. None of these studies has examined 5G millimeter waves. 5G employs specialized technology including phased arrays, beam-forming, and massive MIMO (sending multiple data signals simultaneously over the same radio channel). 5G millimeter waves may be more biologically active and result in more adverse health effects than the earlier millimeter wave studies found."

Objection #6: Injury from secondary, endogenous RFFR: Sommerfeld and Brillouin precursors

- 1. Sommerfeld and Brillouin precursors are induced, propagating transient RFFRs generated endogenously in the human body (or other mediums) from an exogenous source RFFR with a changed sinusoidal structure (about 6 times smaller amplitude) that displaces charged particles in human tissue, thus damaging those particles. (A117). This means that Sommerfeld and Brillouin Precursors are RFFR that propagate endogenously within the body from a source exogenous to the body without attenuation and travel faster than the source pulse. They induce movement of proteins, DNA, and ions of potassium, sodium, chloride, calcium, and magnesium. (A117) These movements damage cells and organs [Albanese,R, Blaschak, J, Medina, R, Penn, J. "Ultrashort Electromagnetic Signals: Biophysical Questions,

Safety issues, and Medical Opportunities.” *Aviation, Space, and Environmental Medicine*. May 1994: A116-A120 (“Albanese May 1994”.; see also OMB No. 0704-0188 94-24875 AD-A282 990 dated Jan 90-Aug 93; Jakobsen PK and Masud Mansuripur. “On the Nature of the Sommerfeld-Brillouin Forerunners (or Precursors.” *Quantum Studies: Mathematics and Foundations* (November 8, 2019)] Thus, 5G beams immerse the body in a 10-degree RFFR, enter the skin and breed new, induced RFFR that travel faster than the original pulse with the radiation of the propagated RFFR damaging cells deep in the body just as 4G RFFR does.

2. Regarding the failure of FCC safety limits to consider Sommerfeld and Brillouin Precursors, Albanese stated “However, IEEE C95.1, 1991 was developed from biomedical data on pulses whose onset and offset times (or rise and fall times) were much slower than those shown in Fig 2; the standard does not embody the precursors phenomenon. Thus, in practical term, the sharp ultrafast category of pulses being discussed are not covered by IEEE C95.1-1991 or by any other formal guideline known to us...**Until the issue of tissue damage mechanisms associated to pulses that cause precursors is fully studied, the authors recommend zero human exposure to such unique precursor and gendering pulses.**” [Albanese May 1994, A118]

Objection #7: FCC antenna safety standards applied to MCPBS ignore radiation injury to living organisms at power densities many times lower than the FCC antenna safety standards.

- A. FCC antenna safety standards: 6,000,000 to 10,000,000 $\mu\text{W}/\text{m}^2$ based upon frequency.
 1. These FCC safety limits ignore actual injury from radiation at much lower limits than 6,000,000 to 10,000,000 $\mu\text{W}/\text{m}^2$. Six CA firemen received brain and neurological injury from MCPBS on the roofs of their fire stations emitting 10,000 to 20,000 $\mu\text{W}/\text{m}^2$. [Letter to two secretaries Revision 01 dated 01.08.2019, Exhibit N]

Rep. Abrami, have you heard of this California study before?

Abrami: yes

- B. International antenna safety standards:

Compare the safety of FCC safe limits of 6,000,000 to 10,000,000 $\mu\text{W}/\text{m}^2$ with other countries antennae safety limits. The wide range in country antenna safety limits means **no country really knows antenna safety limits and that the US, with the highest antenna safety limits is clearly in conflict with all other countries in this list.** [Remke, Amar and Mahesh Chavan. “A Review on RF Exposure from Cellular Base Stations.” *International Journal of Computer Applications*. 104(12) (Oct 2014): 9-16]

Power density

%US

Country or other geographical area	W/m ²	μW/m ²	
USA public exposure guidelines at 1800 MHz	10	10,000,000	100%
India	9.2	9,200,000	92%
Canada (see Attachment)	3.0	3,000,000	30%
Australia	2	2,000,000	20%
Belgium	1.2	1,200,000	12%
New Zealand	0.5	500,000	5%
Exposure limit in CSSR, Belgium, Luxemburg	0.21	210,000	2.1%
Exposure limit in Poland, China, Italy, Paris	0.1	100,000	1.0%
Exposure limit in Italy in areas with duration hour	0.095	95,000	0.95%
Exposure limit in Switzerland	0.095	95,000	0.95%
Germany: Precautionary recommendation only	0.09	90,000	0.90%
Italy: Sensitive areas only	0.025	25,000	0.25%
Exposure limit in Russia, Bulgaria, Hungary	0.02	20,000	0.20%
Austria: Precautionary limit in Salsbury only	0.001	1,000	0.01%
Germany BUND 199	0.0009	900	0.009%
New South Wales, Australia	0.00001	10	0.0001%

(1) Building Biology Institute RFFR anomaly standards for up to for sleeping: They consider 1,000) μW/m² as an extreme anomaly. They suggest for sleeping purposes that you have considerably less than 1,000) μW/m². For example, I have shielding paint on two bedroom walls of my home which brings me down to near zero.

	None	Slight	Severe	Extreme
a. Radio frequency field radiation (High freq., EM waves) μW/m ²	<0.1	0.1 – 10	10-1000	>1000

C. RFFR power density meter readings from emissions of a MCPBS (MCPBS) taken 06.09.2020 by HK. MCPBS located 150 feet from about 100 two-story apartments with more apartments adjacent and to the east of the front 100 apartments. Meter readings taken about 100 feet from the MCPBS and 50 feet from apartments. Meter used: Safe Living Technology Safe and Sound Pro II. (Herman’s research)

1. Power density meter readings in $\mu\text{W}/\text{m}^2$:

108,000	97,300	224,000	159,000
212,000	97,300	147,000	135,000
97,300	311,000	162,000	145,000
135,000	580,000	175,000	200,000
147,000	208,000	224,000	

2. Descriptive statistics

Average	196,663 $\mu\text{W}/\text{m}^2$ Rounded 197,000 $\mu\text{W}/\text{m}^2$
Stdev	109,569 $\mu\text{W}/\text{m}^2$
Coefficient of variation	0.56

3. How would you like to live 150 feet from a MCPBS emitting an average power density of 197,000 $\mu\text{W}/\text{m}^2$ when 6 CA firemen received brain and neurological injury from MCPBS on the roofs of their fire stations emitting 10,000 to 20,000 $\mu\text{W}/\text{m}^2$.

If you look at these statistics with the bolded very high values and recall that the firemen were injured at between 10-20,000. These poor people in 100 apartments are living within 50 feet of this power density.

Abrami: so Herman, this is interesting. I know a lot of people look at the readings based upon an average. What is your feeling on an average v. what the peak would be?

Kelting: Perhaps, I was not clear on that. These are all peak readings. What I do is turn on my meter and clear it and for 15-20 secs it registers peak, hold and gets the highest peak and that's what I record on here. These are not averages. Averages are much lower. Probably less than 10%. Peaks injure.

Sherman: Could I ask a question? So is it how long you are exposed to peak, is the duration of exposure as important as the intensity?

Kelting: It's a combination of both. Remember now, you are talking about a macro cell phone base station pulsating RFs, the peaks of which are within a 20-30 second interval are as I recorded here. This goes on 24x7. Theoretically if you came back one hour later or two days later, you are going to get about the same distribution and the same averages..

Chamberlin: My question involves the bandwidth. Of course, the wider the bandwidth, the greater the peak you will see because you will be looking at a superposition of a greater number of frequencies. Do you happen to know the bandwidth?

Kelting: no. I do not. I only measure radio frequencies and that could probably be one of the inadequacies of my work. But you have alerted me to that and I have a meter that measures frequencies so perhaps in the future I can consider that.

Abrami: But here's the thing. These are still within the FCC standards. Correct? The question on the table is, is the FCC standard set too high?

Kelting: That's correct.

Kelting: On January 14, 2020 I wrote a letter to the Clark County Board of Commissioners on two sets of macro towers and cell phone base stations. One was emitting up to 218,000 micro watts per square meter about 100 yards from the two facilities which was about 100 feet from homes and the second was power densities on a building with two antenna on top which were concealed incidentally. They were emitting in the building up to 37,100 $\mu\text{W}/\text{m}^2$. That building is a Community Center.

D. Studies of harm from 4G MCPBS at power densities small fractions of FCC MPE limits,

1. In a study of 1000 individuals living for ten years within less than 400 meters from a GSM cellular transmitter site in Germany, it was found that the likelihood of getting cancer was three times greater than for those not near a cellular transmitter and that the patients fell ill an average 8 years earlier. Radiation in the inner area was 100 times the radiation in the outer area. The authors concluded it was necessary to monitor the health of individuals living near high radio frequency emissions from cellular base stations. [Eger, Horst, Klaus Uwe Hagen, et. al. "The Influence of Being Physically Near to a Cell Phone Transmission Mast on the Incidence of Cancer." *Umwelt-Medizin-Gesellschaft* 17(4) (2004): 7 pages]. (Sisolac 08.29.2019, 12-13)
2. An apartment building with two cell phone base stations on the roof had a mean power density of 3,811 $\mu\text{W}/\text{m}^2$ with a power density range of 15.2 $\mu\text{W}/\text{m}^2$ to 112,318 $\mu\text{W}/\text{m}^2$. The mean radiation was reduced by 98% when the power density from the two cell phone base stations was disregarded. The authors concluded:

"Due to the current high RF radiation, the apartment is not suitable for long-term living, particularly for children who may be more sensitive than adults...the simplest and safest solution would be to turn them off and dismantle them."

[Hardell, Lennart, Michael Carlberg, et.al. "Radio Frequency Radiation from Nearby Base Stations Gives High Levels in an Apartment in Stockholm, Sweden: A Case Report." *Oncology Letters* 15(5) (May 2018): Pages 1-29]. (Sisolac 08.29.2019, 12-13)

3. In Belo Horizonte, Brazil, it was found that deaths from neoplasia (i.e., abnormal growth of tissue; cancer) increased with close proximity to cell phone base stations. For those living within 100 meters of a CPBS, the death rate was a relative risk of 1.35, for 500 meters 1.08, and for 1000 meters 1.00. The death rate from neoplasia varied from 5.83 per 1000 individuals to 2.05 per 1000 individuals. Cell phone base stations were concentrated in the Central Southern region and varied from 8,980 $\mu\text{W}/\text{m}^2$ (0.898 $\mu\text{W}/\text{cm}^2$) to 30,660 $\mu\text{W}/\text{m}^2$ (3.066 $\mu\text{W}/\text{cm}^2$) in 2003. Brazilian power density standards were 4,513,400 $\mu\text{W}/\text{m}^2$ (451.34 $\mu\text{W}/\text{cm}^2$) at 900 MHz and 9,024,900 $\mu\text{W}/\text{m}^2$ (902.49 $\mu\text{W}/\text{cm}^2$) at 1800 MHz.

Notably, the death rate from neoplasia in Belo Horizonte occurred at power densities much lower than the US standard of between 6,000,000-10,000,000 $\mu\text{W}/\text{m}^2$. [Dode, AC, Et.al. "Mortality by neoplasia and cellular telephone base stations in the Belo Horizonte municipality, Minas Gerais state, Brazil" *Science of the Total Environment* 409 (2011): 3649-3665].

4. In a study of tree damage in Germany, it was discovered that cell phone base stations damaged the sides of 60 trees facing the MCPBS. The median power density from the MCPBS on the damaged side was 995 $\mu\text{W}/\text{m}^2$ and on the undamaged side was 125 $\mu\text{W}/\text{m}^2$ using peak and peak hold values. A power density of 995 $\mu\text{W}/\text{m}^2$ is obviously far less than the FCC safe threshold of 6,000,000 to 10,000,000 $\mu\text{W}/\text{m}^2$. It is also a little less than the Building Biology recommendations of less than 1,000. The authors quote from M. Repacholi, head of the International EMF Project of the WHO (p. 567), who said in part: [Waldmann-Selsam C, et.al. "Radiofrequency Radiation Injures Trees Around Mobile Phone Base Stations" *Science of the Total Environment*. 572 (2016): 554-569.]

"Given that any adverse impact on the environment will ultimately affect human life, it is difficult to understand why more work has not been done...research should focus on the long-term, low level EMF exposure for which almost no information is available"

5. In an Israel study of cancer rates near a cell phone base station, it was discovered that 3-7 years' exposure times had cancer rates 4.15 times the cancer rate in the entire population and that the cancer rate for women was 10.5 vs. 1.0 for the whole town of Netanya. The power densities were "far below" current guidelines of 5,300 uW/m^2 (0.53 uW/cm^2) for thermal effects. [Wolf, et. al. "Increased Incidence of Cancer Near a Cell Phone Transmitter Station." *International Journal of Cancer Prevention*. 1(2) (April 2004).]
6. In a Greek study of the reproduction of rodent births in response to a microwave power density of 1,680 $\mu\text{W}/\text{m}^2$ (0.168 $\mu\text{W}/\text{cm}^2$) it was found that the rodents became sterile after five generations and those exposed to 10,530 $\mu\text{W}/\text{m}^2$ (1,053 $\mu\text{W}/\text{cm}^2$) became sterile after three generations. Note that these damaging-to-living-organisms' power densities are considerably less than the FCC safe limit of 6,000,000-10,000,000 $\mu\text{W}/\text{m}^2$. [Magras IN. "Radiation induced changes in the Prenatal Development of Mice." *Bio electromagnetics* 18 (1997): 455-461 cited in A Balmori. "Electromagnetic Pollution from Phone Masts. Effects on Wildlife." *Pathophysiology* 16 (2009): 191-199.,]

Objection #8: FCC antenna safety standards disregard power densities emitted by body proximate devices (i.e., personal property).

- A. There is only a heat standard for body proximate RFFR emitting devices and it has been shown many times there is radiation injury even though the heat standard is met.
- B. In a letter dated February 7, 2014, the Office of the Secretary of the Interior, stated:
“The electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today.”

Objection #9: RFFR meters understate power densities from multiple nearby RFFR emitters.

This means that when you meter an area with two or more emitters, the peak power densities will not measure appropriately the addition of the second to the first and here is why.

Assume two single 4G MCPBS emitting antennas each emitting peak power densities of 10,000 $\mu\text{W}/\text{m}^2$ with a combined theoretical peak of 20,000 $\mu\text{W}/\text{m}^2$.

When you meter, you should probably get at some point a peak of 20,000 $\mu\text{W}/\text{m}^2$. You will not get that because antennas will be emitting **unsynchronized** peaks and lows. The probability of measuring two MAX peaks of 10,000 $\mu\text{W}/\text{m}^2$ each for a combined total power density of 20,000 $\mu\text{W}/\text{m}^2$ is zero. Thus, if we have a metered instantaneous peak of 8,000 $\mu\text{W}/\text{m}^2$ for Antenna #1 and a metered instantaneous peak of 4,000 $\mu\text{W}/\text{m}^2$ for Antennas #2 for a combined instantaneous peak of 12,000 $\mu\text{W}/\text{m}^2$, 12,000 $\mu\text{W}/\text{m}^2$ will be the peak for the two combined antennas, which is $12,000/20,000 \mu\text{W}/\text{m}^2 = 60\%$ of the true combined peaks. You will likely never get the true a peak of 20,000 $\mu\text{W}/\text{m}^2$.

Abrami: Let’s pause there. Does anybody have any questions? None. Ok keep going Herman.

Objection #10: Legal vs. equitable standards to measure safe human exposure limits, US statutes and case law.

- A. Legal Standard is from Telecommunications Act of 1995 Section 704(a)(7)(B)(iv) Public law 104 104th Congress 110 Stat 66:
“No state or local government...may regulate the placement, construction, and modification of personal wireless facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the Commissions regulations concerning such emissions.” [Telecommunications Act of 1995 Section 704(a)(7)(B)(iv) Public law 104 104th Congress 110 Stat 66].

In my opinion, Telecommunications Act sets a legal statutory, not equitable standard, for safety unrelated to actual known injury. **704(a)(7)(B)(iv) is unconstitutional because it violates equitable safe power densities.**

- B. It is essential that equitable standards of the National Environmental Policy Act not be overridden by federal legislation. I believe there is a bill in Congress that is attempting to override the National Environmental Policy Act (NEPA).

One of the fairly good cases is.

1. In *United Keetoowah Band of Cherokee Indians in Oklahoma, Individually and on behalf of all other Native American Indian Tribes and Tribal Organization et al Petitioners vs Federal Communication Commission et al* No. 18-1129 decided August 9, 2019, the court was faced with the following issues and factual situations and held as indicated:

2. *Principal issue:* Was the FCC order “Acceleration Wireless Broadband Deployment by Removing Barriers to Infrastructure

- (1) “All ‘major Federal actions significantly affecting the quality of the human environment’ trigger environmental review under NEPA...42 USC §4332(C). Major federal actions ‘include actions ...which are potentially subject to Federal; control and responsibility.’ 40 CFR §1508.18. Under the Commissions procedures implementing NEPA, if an action may significantly affect the environment, applicants must conduct a preliminary Environmental Assessment to help the Commission determine whether ‘the proposal will have a significant environmental impact upon the quality of the human environment’ and so perhaps necessitate a more detailed Environmental Impact Statement 47 CFR §1.1308; see also 40 CFR §1.1508.9. [7]

The summary of the legal issues that I have in this section is to emphasize equitable standards not legal standards, which are unconstitutional.

Abrami: Let me pause you there Herman. So you are saying that for Indian reservations, different rules can apply now?

Kelting: No. I am not saying that. First of all, I am not a legal expert on Indian Reservations and outside of them. But what I have just quoted you from was from a federal law that is not specific to Indian Reservations. It was applied to Indian Reservations but is broadly applicable in my opinion, to all other circumstances as well. In other words, the NEPA is broadly applicable to all situations where there is environmental injury. That is why we need to use equitable standards not legal standards.

Abrami: So let's take section a/ The FCC granted licenses for the telecommunication companies to install SCA on Indian lands without any historical preservation or environmental review. So what did they do? What happened in this case?

Kelting: I don't know. I think the case was the DC court of appeals.

Objection #11: RFFR-emitting devices may interfere with reception of the Schumann Resonance

- A. The Schumann Resonance is a set of Extremely Low Frequencies caused by lightening in the ionosphere/atmosphere with a main frequency of 7.83 Hertz (cycles per second) and harmonics of 14, 20, 26, 33, 39, and 45 Hertz. Those resonances are very similar to the RFFR harmonics in the human brain.
- B. Practical application of Schumann Resonance
Experiments with individuals living underground indicate they became depressed until the Schumann Resonance was added to their environment. To give you an illustration here, I used a bike helmet lined with a heavy duty tin foil and got a severe headache several times. The tin foil of course should protect me from outside frequencies. When I removed the tin foil, I did not get the severe headache. My hypothesis was that maybe I had become separated from the Schumann Resonance like underground humans and that separation caused the headache.

Abrami: Before you go on Herman, does anyone recall? Didn't we talk about the Schumann Resonance somewhere along the line at one of our meetings? No? Ok. It sounded familiar.

Objection #12: 5G/4G SCA legislation does not provide a reasonable accommodation for those with Electromagnetic Hypersensitive.

- A. SCAs will be universally installed throughout cities and those who are EMH will have no place to go for freedom from RFFR. Your choices will be stay in your home or suicide. There is one lady who has EMH in a place where they have installed 5G and she has to have her meals delivered to her in her house. She can't go outside.
- B. Kalamata, Greece did a pilot study of 5G/4G and rejected it partially on the grounds of no protection for EMH individuals.

Objection #13: Environmental power densities should be disclosed in transfers of interests in real and personal property or in the use and occupancy of public buildings.

- A. Objective: Inform the public of the quantity of power densities ($\mu\text{W}/\text{m}^2$) in their environment.
- B. Regulatory issue #1: Power density disclosure to buyers and lessees of residential real estate.
 - 1. Power density disclosure of $\mu\text{W}/\text{m}^2$ to buyers and renters by state law. State law should require environmental assessments

- a. Meter immediately outside the housing unit. "Outside" means around the outside the walls of the building including only the detached housing unit or around the outside walls of a multistory building containing several housing units all at ground level.
- b. Meter inside the housing units within three feet of all interior walls during ordinary working hours or evening hours as required by the buyer or lessee. Date, day, and time must be shown on the inspection.
- c. Estimate spillover RFFR from adjacent housing units if you are in an apartment or a condominium. Turn off electricity in target housing unit and turn off all RFFR devices. The remainder RFFR is from outdoors or from spillover RFFR from an adjacent housing unit. Can estimate spillover RFFR my metering near party wall. I have personally measured wifi once that was throwing off a million ($\mu\text{W}/\text{m}^2$). I believe that was in the far field three feet away. That's terrible. That means that across the party wall, those people are probably getting 900,000.
- d. Measure of harm: Imagine a six-month old baby crawling on the floor with a 1,000,000 $\mu\text{W}/\text{m}^2$ Wi-Fi nearby in the same or spillover adjacent apt. Getting his or her brain fried from grossly excessive RFFR/EF. That child is going to be injured, perhaps for life.

Abrami: Herman, let's talk about this for a minute. The upper limit of the federal guideline is 10 million $\mu\text{W}/\text{m}^2$ right? Or ten W/m^2 and your example is only one tenth of that FCC limit.

Kelting: Yes and my proposal in informing the public, does not include a safety standard within the legislation. It will only say that every home and apartment will be metered and the results delivered to the renter or the buyer. There will be no notice of what is safe or not safe. The purpose of that is to avoid criticism in comparisons with the FCC. Let people start doing their own research and when they do, then you are going to get complaints. I am thinking this is the golden arrow to defeat the FCC.

Abrami: Right. I think I understand what you are saying. Publish what the readings are and let people make their own decisions.

Kelting: Exactly. It will come to a point where people will say, I am not going to buy your house because I am getting 10,000 $\mu\text{W}/\text{m}^2$ and over there at that house, I am only getting 20 or 30. I bought my house in an area by metering first. I selected my house in an area with low radio frequencies, typically less than 10.

Abrami: Ok. That's something that the Commission will be thinking about.

- C. Regulatory issue #2: Need power density disclosure and prohibition of use of RFFR emitters in public buildings.
 1. "Public buildings" mean all buildings that have unrestricted public access including government buildings, retail stores selling personal property or services, restaurants, exercise facilities, etc..
 2. The disclosure should be made using a time-dynamic RFFR meter showing power densities in $\mu\text{W}/\text{m}^2$ with one time dynamic meter for the lesser of 10,000 square feet of floor area or the actual space. This is so when you go in a building, you know what the power densities are. Those densities will include any cell phones and

wireless devices in the building. That's the beginning of managing radio frequencies in buildings in my opinion.

3. Prohibit use of wireless devices in public buildings (e.g., government buildings, schools, anyplace there are concentrations of people in an enclosure). I am also suggesting this after being a government agent and working in government buildings for thirty years of my life. Now that means that people won't be able to talk to their children at three o'clock while at work or talk to their buddies. That will reduce the power densities in buildings. Furthermore, there are issues of trespass. When you have a cellphone that is emitting a beam that is hitting my body, you are trespassing on me which, in my opinion is illegal under equitable standards.

D. Regulatory issue #3: Need power density disclosure to buyers of RFFR-emitting personal property (e.g., cell phones, Wi-Fi, cordless phones, automobiles) at point-of-sale.

1. Electric field within about one inch of the item (near field), if not a moving vehicle
2. Power densities (i.e., $\mu\text{W}/\text{m}^2$) within three feet (far field) of the device, if not a moving vehicle.
3. For autos, meter inside vehicles in an environmentally near zero geographic area.

So in addition to the mpg on a car, there should be power densities in that car as well. The same thing for wifi, cell phones, etc even though I recognize differentials in signal and signal availability is a factor.

That pretty much closes it. I would like you to comment on what you felt about this presentation.

Abrami: you summarized a lot of work that we had gone over before the shutdown. This is all good. Some of the last comments about not having cellphones in buildings, that's a tough sell.

Kelting: yes. But if you start doing some other things like disclosure in rental and buying property, then people will become acclimated and want disclosure.

Abrami: Well let's open this up.... New Zealand, for example, their standard is $500 \mu\text{W}/\text{m}^2$ or 5% of what our standard is. We have talked about this many times. How can we be so high of a standard and other countries take a totally different position? It's all over the board. Australia is 2,000,000 and Canada is 3,000,000. We have been discussing this a lot which is why we have been trying to get in touch with the FCC to answer our questions. It is hard getting through to them.

Kelting: It's impossible because they are controlled by the telecommunications industry. What happens with federal agencies is that eventually substantially all of them are controlled by the industries they regulate because their managers are essentially appointed by those being regulated.

Abrami: yes. We have heard all those arguments. As a state we can't set up standards. All we can do is warn and give guidance. I want to at least be able to say that we have tried to reach out to the FCC and FDA and others because someone is going to say why didn't you talk to the FCC? We just have to be able to say we tried and have gotten no response.

Chamberlin: At this point, after what I have read and after having other presenters before you and hearing what you are saying, I am totally convinced that there are deleterious effects on health due to radiofrequency exposure. I am sold. But, what I don't know is relative risk. In other words if I have a cell phone and live near a cell tower what is my risk compared to say, smoking or driving a car? Do we have

some dose relationship between exposure and risk? Am I ten times more likely to die from cancer if I have a cellphone? Can you put some context behind this and give me some relative understanding of how exposure is risky?

Kelting: My answer to that question is the probability of extinguishing humanity in sixty years if we continue the rate we are going even without 5G is about 100%. We are in a process of destroying humanity right now and the evidence is being concealed. My letter of complaint incidentally on that case went to the Federal Bureau of Investigation.

Abrami: They didn't respond, I imagine.

Kelting: no.

Gray: I find objections to most of what Mr. Kelting has presented today. I can't count the number of times in his presentation he said, in my opinion. I can't count the number of times he has referenced studies that have been disproved by other things. I would admit that there probably is a radiation level that I can probably reach that would be deleterious to humans but to talk about extinguishing the human race, to talk about suicides and all these other things with studies that have not been reproduced, have not been verified and are using high levels of radiation or animals or different species that aren't humans who aren't affected the same way and taking that as gospel. I just can't get there. Thank you.

Kelting: Senator, you could if you were Electromagnetically Hypersensitive as I am because I can feel the junk.

Heroux: I think that to answer your question as to evidence that there is or isn't... in order to assess the health effect, you have to measure it and you have to believe that there is something to measure. In relation to electromagnetic radiation, when the federal government through the FCC expresses an opinion about risk that is so clear, that there is no risk below thermal levels, there hasn't been much incentive to perform measurements. There are individuals who attempted to do this. So the only variable with relatively reliable documentation is cancer. This is a variable that has a digital quality to it. Either you have it or you don't. There are international bodies who measure this in a routine fashion. What we have on this subject as you already know, are the two reports from International Agency on Research on Cancer that says low frequency and radio frequencies are related to cancer as well as a number of studies like this Brazilian study that I think is very convincing on the impact of cell phone towers because not only do they determine from an established set of cancers but your probability of dying from it is higher if you live near a cellphone tower. The problem essentially with Dr. Kelting's presentation is that he goes to a large number of effects on which there is relatively little proof because it hasn't been investigated in a very systematic way. So, we don't have the means to investigate everything in detail but perhaps cancer is an exception. Thank you.

Abrami: Let's bring this back to 5G vs. cell phones or whatever. The real issue is our communities are going to be asking for guidance on 5G. If they roll out small cells in any community, they will be rolling them out in front of people's homes low to the ground and the great mystery to all of us is how much energy is coming out of them and is it safe to walk near one of these? Obviously, industry is probably saying yes, they are very safe. We wouldn't do it if it wasn't safe. There is enough evidence out there of ills from RF radiation on all topics. You name it, there are plenty of studies. From the beginning, we have

asked, have the studies been replicated? But to me, there is enough evidence of concern. We will all have to put ourselves in the position of asking ourselves if the cell company came by and put an antenna on top of my telephone pole that is 100 feet from my house, would I think that's a good thing or a bad thing? At this point, I wouldn't be too excited about it because I am not 100% convinced that there is not some concern for safety. Maybe it's not conclusive evidence as of yet but I think the body of evidence will have to be built over time. That's the concern that we have to address for the state of New Hampshire and for the communities and citizens in the communities. That's a tough thing to get our hands around but that's what we are being asked to do.

Sherman: I was just going to second what you are saying. Whenever you are looking at studies of human health especially with potentially deleterious exposures, one other that we are grappling with is PFAS. How good are the studies on PFAS? Well, they are good enough to say everything is pointing in a bad direction. Is there something that is absolutely unequivocal? We know that with Mesothelioma and asbestos and bladder cancer and arsenic or smoking and lung cancer? No.

Is there something right now with 5G that says, boy this is really bad for us? I think it depends on who you ask. But you have got a very large, very well-funded, very powerful industry saying, trust us. We wouldn't do this if it were damaging or harmful to human health. It reminds me of some other industry issues we have had in the past saying trust us and not trying to make sure the data is robust. Therefore the data is suggesting that there is no harm. So we are left with the Precautionary Principle of public health which is, we have enough evidence to be concerned but not enough evidence to be definitive as far as I can see from sitting in on these things and what do we do?

I think the most troubling thing for me is that especially in New Hampshire but throughout the country, there is a certain amount of choice of what we expose ourselves to. With 5G, that choice is gone. Unless you want to stay in your home and wrap yourself in aluminum foil, you don't have that choice. You get into people's personal choice. We have a choice whether or not to use a cellphone but we don't have a choice if the 5G tower is going to be right outside our window because the FCC covers that. They are in charge. That is what I find to be the single most troubling aspect to this. This isn't something I can choose like what kind of drinking water I will be drinking. I can choose whether or not I smoke cigarettes. In this case, I don't have a choice. The bees don't have a choice. The environment doesn't have a choice. The trees don't have a choice. And if we get this wrong and the industry is wrong or is suppressing knowledge, which we have seen before for example in tobacco. We could be screwed, to use a medical term.

Patrick, I think you are on the right track which is saying how do we embrace what we have always embraced in New Hampshire which is our personal choice as well as our personal responsibility and recognize different people's interpretation of what is so far to me is not absolute data and what can we come out of this with in terms of recommendations? I think one recommendation is you are not going to go wrong if your community says, no 5G until we know it's safer but my concern is that we may not be able to do that.

Abrami: There are communities that have said that. It becomes how long does that last before the lawyers catch up with that and the company wins that argument. That's something that we have to consider. Whatever we do we have to be pretty confident that it will cut muster and terms of legal action or legal recommendation. I think there are things we can do to nibble around the edges on this. I

think that's what we want to do as a subcommittee is to put some things together that we think might be viable.

Sherman: I also wouldn't try to litigate this in any recommendations. I wouldn't guess where these lawsuits are going to go if a town says no 5G or something like that. I think we can certainly recognize that there is the risk of litigation or some would say with certainty if you try to close the door to 5G. I find that very troubling that an entire community would not have ability to say no to something that has some significant evidence that it may be harmful.

Kelting: How many of you own RF meters? For those of you who believe that RFs are safe, buy a meter and defend its safety based upon what you meter.

Heroux: I can recommend for you a meter, the GQ EMF390 for about \$200 you can get an ELF meter that goes to about 10Ghz and also has a frequency analyzer. It is truly a quantum leap in what is available to the consumer. It is made by an American company. It can monitor the fields every second for 24 hours and download it into your computer. So a lot of the measurements you are talking about for protection of housing and buildings become feasible when you have that kind of sophistication available to everyone.

Ricciardi: I wanted to make a couple of comments and thank Senator Sherman because I echo what he is saying. There are a few things we have to remember. We definitely have enough science and evidence to show that things are unclear and unsafe. But if we were to go and say, ok the Telecommunications Act, the FCC has not provided us with proof that is safe. That is the problem. When you are putting 5G in front of people's homes, we have to remember that it doesn't work alone. It has to have 4G with it so essentially you are forcing someone to live in a soup of microwave radiation because the science is there with the 4G. Really, that is unconstitutional.

In addition to that, we are not a town deciding whether we should roll out 5G or not. We are a group of people that have been selected on what is the best thing to do for the state of New Hampshire. It doesn't mean we have to talk about litigation because our job is to make strong recommendations on our findings whether it's agreed upon or not but that's what we have been tasked to do. That's what we have to do. We are making what we find to be an important decision for the state of New Hampshire.

Abrami: Yes. We do but again I still feel that they have to be, I don't want to say reasonable but that would not violate federal law. I think that one of the recommendations may be that our federal legislators need to do more. I think this is something we need to continue to discuss how far we want to go with this.

Woods: I have a technical question. What chance are we going to have to sort of have an executive session? I don't need to get into detail but some things that Paul and I have raised and Ken and Kent as well. I think some of the basic science things need to be reiterated perhaps. Again, we don't know all of the outcomes but if we can provide a little bit of discussion about the real basic science like we talked about proton tunneling. Our presenter brought up the issue of precursors. I think that is an important issue and I don't think people understand what a precursor is but that can have a significant impact from a quantum mechanical perspective. We have done a couple of things. We have brought this down from concern only about the ionizing radiation. We did point it out to one of our presenters no, that doesn't count. You need to talk about the non- ionizing radiation. I think even though we don't have all of the

answers, I think we can provide in our report the concerns that we have and point out that there is some basic science at the quantum mechanical level that will support that. That needs to be done because of A, B and C consequences.

Getting back to my original question, are we going to be able to do some exec sessions where we can talk about that among ourselves and flesh out some of these other issues?

Abrami: We can't have exec sessions as a whole. They need to be public. We can meet as subgroups I think up to 50%. I would love to see that actually of the more technical folks in the group. All this information is great. We have gathered a lot of good information that we need to not lose. That should be available in the report to all our communities in New Hampshire. Here are some of the facts that we found so far.

Sherman: I was just thinking that maybe before you start your subcommittees maybe the next Commission meeting could be free discussion among the Commission. There is enough resource here, people with enough knowledge. I have some questions about some of the testimony both today and in the past that I would love to just bounce off other Commission members.

Abrami: Tom, at this point I am not planning on inviting any other guest speakers because I think it's time for us to do exactly what we are talking about here. We have to start talking among ourselves and I see a lot of heads shaking yes. I think that is what we will definitely do next meeting.

Woods: That is sort of what I had in mind when I said exec session. I didn't mean exec per se but what Tom is referring to about having an open discussion.

Sherman: And then the subcommittee could take that and I know there has been some really great feedback from Commission members, great questions, and a lot of information. So having a session where we can distill that down and then the subcommittee can then go get to work. We can get a little clearer from all of us, where each of us is. Pat, I don't know maybe it would make sense for each of us to maybe start out with saying where we are and then have a discussion after that of where we are as a Commission.

Abrami: I think that is a good idea. Assume the next meeting will be two hours of discussion among ourselves about where we are at. Everybody will have a chance to weigh in on their position. I think I have a sense but you never know. Then we talk through what we think the structure of a report will look like, too. I don't want to lose some of the knowledge that we have. The report will include the minutes of these meetings as an attachment. Our minutes are quite extensive. I know when I did the report for the marijuana Commission, that report was 200 pages long with all the attached minutes we had to it. There is a lot of information in those minutes that I think is valuable.

Chamberlin: The reason I go back to relative risk is because with a number of things available to us there is a risk associated that we decide is acceptable. Here is an example: We drive cars and yet we lose 30,000+ people per year with traffic accidents. They die but we consider that to be acceptable. With something like 5G, it will clearly have benefits associated with it. Is the risk relatively low that we can go ahead with it? Or is it such that we can't? That is the one thing that hasn't come out in all the testimony that we have heard. How much of a risk is it? Is it comparable to smoking five packs of cigarettes a day? I don't know. If we are going to get traction with this politically, we need to be able to impose the realism

that this is a significant threat or perhaps it isn't. But that's one thing that I haven't yet found out in my reading either. Can anybody shed any light on that?

Woods: To me, there are two parts to the risk. One is the relative risk and the other is exposure to risk. With driving a car, you can take the back roads and stay off the highways but with 5G, you may not have that choice. There is exposure risk vs. personal acceptance risk and that has to be differentiated as well.

Wells: Just a couple of things that Dr. Kelting said today that I wanted to make sure didn't get lost. He talked about disclosure with real estate, etc. and also about RF trespass on my body or on my home. I am thinking there might be a parallel here to 20th century strip mining in Pennsylvania where a farm owner didn't own the mining rights and found himself sitting on a pile of gravel the next day. I am wondering if there is some sort of precedent here that we should be looking at.

Abrami: Herman are you still on with us?

Kelting: Yes. I am here but I am not familiar with strip mining or the case law associated with it.

Abrami: Ken, I am not sure myself but that is a good question though.

Wells: The idea of signal trespass onto my property. Dr. Woods was just talking about whether you can choose to expose yourself to the risk or not. In the case of driving, you can. Whether you decide to smoke or not, you can. But this is more like a second hand smoke kind of thing. You can't protect yourself from it under the current circumstances.

Abrami: the other thing is 5G hasn't really been rolled out extensively yet. The other problem we have with 5G is that it's a marketing concept. Each company, it means something different. Ken, I know we have talked about antennas. What's inside the antenna? How are they configured? I think one thing we can grapple with is how much energy is coming out of the antenna. I think we have boiled it down to that. The FCC standard is set so high that even if we said as a community there would be periodic monitoring of the levels that seems like it's pretty high intensity to have on top of a pole twenty feet off the ground. I think the industry would say no it's not that level of intensity coming out of that but we don't know. A lot of that is proprietary information. We don't know what the intensities are going to be.

One of my thoughts was let's monitor. Let's say a community in agreement with the cellular company says that it should not exceed FCC standards. But those standards are way high. The cellular company shouldn't object to that since they feel that things are safe within the FCC limits. My instinct is that 10 W/m² is very high level. As I said before, why did New Zealand set their standards at 5% of our levels? I don't know. Maybe they are just being more cautious. But it makes you think. Why do some countries have totally different standards than our standard? Some would say they are erring on the side of caution as Tom would like to say. Well, how can they get away with their 5G at their standards and we have standards set at 10 W/m² ? These are conversations that should be happening at the federal level really. We would love to talk to the FCC. We would love to have them on our zoom meeting right now answering our questions.

Ricciardi: I just asked when you say that FCC says this is safe then why does the Telecommunications Act say health cannot be a consideration? If it's so safe, why would that be in there?? Just a question.

Abrami: and it's a good one.

Kelting: I would like to mention one thing here. For 4G, you could insulate your body with silver embedded cloth. With 5G at the higher frequencies, you will be required to use tin foil only. It will go right through cloth even with silver threads.

Gray: Beam forming is something that I don't know that we have explored very well. It would seem to me that beam forming would cause very short time increases in radiation during the time the beam is formed. But may reduce radiation during times when we are just in monitoring or not in beam forming mode. Things like that are things that are unique to 5G. I don't think we have had sufficient discussions to understand what would happen.

Kelting: When you connect the 5G, if you move your source, it automatically transfers to 4G. So what you are really doing is communicating with 4G in all likelihood. The purpose as I indicated earlier, is that they want to put 4G into residential neighborhoods so they can increase the capacity of the system. It's not to get 5G in there.

Abrami: Help me out here. My understanding is that the 4G cell towers will be communicating with the 5G small cells, is that correct?

Heroux: 5G is an engineering concept that is designed to increase the capacity of the environment to transport data. What industry is really adept at is to transport a lot of data through wireless and essentially with the IOT concept, there is no limit to the opportunities there are to increase the amount of data being transmitted whether you use beam forming or to broadcast it. All of these avenues will be exploited and you will get to the maximum allowed standard ultimately in your environment. This is something that is expected because engineers develop applications in as much as they have the opportunity to do it. What is missing in here is that these agencies like the FCC are essentially blind on impacts on the electro-sensitive people certainly and the other health impacts of this radiation. But the intention of industry is to facilitate communications. Ultimately, wireless is a dead end. It's a little bit like oil because the spectrum is limited and you have to have more and more expensive techniques to transport more and more data. What we should be thinking about is society will need a lot more data. Let's favor optical fiber over wireless because it is not only hygienic, very safe and it has a lot of virtues not being promoted simply because of commercial reasons. Thank you.

Abrami: I just noticed we are getting a lot of chat comments. Kent, is there a way we can save the chat messages?

Chamberlin: Yes. I will save them all.

Abrami: Some of it looks like they will be helpful. There is one that says China and Russia have science-based standards on their evaluation that non thermal effects exist. There standards are certainly set a lot lower than ours. European countries have set precautionary limits. If you can share this with me and I can share it with everybody. There is one on India, which dropped its limits to one tenth of what it was before. Parliament addresses issue of beam forming and measuring issues. There is a report that some of the more technical members are interested in and we can have a discussion around. I guess I am not that much of a Zoom expert. I should have been following some of this chat going on here. We will save it and send it out.

Sherman: on the select committee, we incorporate the chat into our minutes. You may want to do that.

Abrami: We have at least fifty people on and I was told there would be people on from around the country, which is good. Herman. Thank you very much for sharing your information with us. It was very helpful. I want to thank everybody. We are getting applause here from everybody. Again, I wish we didn't have that pause for four and a half months. Got a little rusty here but I think we are back in the groove.

Roberge: Rep Abrami, I have a clarifying question. This was a very helpful discussion. As I sort of prepare for our next meeting on our position and open discussion. I need a little clarity on the charge of the Commission because what I continue to hear and this is a little bit challenging is that 3G/4G and 5G really aren't separate. They are necessary in order for the other to exist. My question is, as we begin to think about recommendations, are we looking strictly at 5G? Is that the charge of the Commission? And how do we differentiate that? That's where I am struggling.

Abrami: Thank you Michele for the question. If you go back to one of our early meetings and it's in the minutes. We early on discovered that you can't talk about 5G without talking about 3G and 4G or RF radiation in general. So, we have to talk about it all. We have learned that you can't uncouple 3/4G from 5G because they do interact with each other. We are going to try to focus on 5G but it's going to spill over to the other technologies as well. Are there any other comments?

Thanks to Kent and UNH. We are using their zoom to hold this meeting. We used your space yesterday too, for a House meeting. Kent and Ken were you there yesterday? I couldn't find you. Maybe I didn't look hard enough.

Woods: Yes. I was here.

Wells: I was wearing a mask. It was hard to recognize me.

V. Zoom Chat from 7-1-20 Commission meeting:

00:26:12 Ken Wells: Does NH have any recourse to Communications Act of 1995 insistence that municipalities and states cannot prohibit installation of antennas?

00:35:28 Ken Wells: Meeting again July 24 @9am via Zoom

01:22:30 EH Trust: I think the case is this: <https://ehtrust.org/federal-court-overturms-fcc-order-which-bypassed-environmental-review-for-5g-small-cell-wireless/>

01:23:08 EH Trust: Here is the link to the case decision
[https://www.cadc.uscourts.gov/internet/opinions.nsf/4001BED4E8A6A29685258451005085C7/\\$file/18-1129-1801375.pdf](https://www.cadc.uscourts.gov/internet/opinions.nsf/4001BED4E8A6A29685258451005085C7/$file/18-1129-1801375.pdf)

01:49:22 Ken Wells: GQ EMF390

01:49:45 Ken Wells: RF meter

01:57:10 Bruce L. Cragin, PhD: You just don't want to hear from any more physicists!

01:59:12 Paul Heroux, Dr.: I am amazed that we could not get the FCC to appear.

02:00:09 Bruce L. Cragin, PhD: More good sense. Thanks for that.

02:00:59 EH Trust: The FDA should do a risk analysis of this type but has refused. Dr. Melnick states this should be done <https://ehtrust.org/statement-by-ronald-melnick-phd-on-the-national-toxicology-program-final-reports-on-cell-phone-radiation/>

02:01:34 EH Trust: "A quantitative risk assessment of the data from the NTP studies on cell phone radiofrequency radiation needs to be performed by the FDA and that information should be used by the FCC to develop health-protective exposure standards. In fact, it was the FDA that nominated cell phone radiofrequency radiation to the NTP, and I quote "to provide the basis to assess the risk to human health of wireless communication devices." Therefore, I urge the FDA to immediately conduct the risk assessment of the NTP data."

02:04:06 EH Trust: Plus there should be an assessment of the impact to birds bees and trees but none has been done. There is no health agency tasked to evaluate and develop a federal safety standard regarding impacts to trees, bees and birds. It is a gap

02:06:01 EH Trust: Montgomery county - Maryland did monitoring and found FCC limits were breached until 10 feet around the antenna facility.

02:06:34 EH Trust: China and Russia have science based limits based on their evaluation. That non thermal effects exist.

02:07:15 lori: State Law 12'K:11 e) needs to be amended to allow testing and monitoring of RF . How can we even know if the FCC standards are being met without monitoring, sampling and testing

02:08:10 EH Trust: Several European countries have set "precautionary" limits . I have these details. And some of the documentation can be found here <https://ehtrust.org/policy/international-policy-actions-on-wireless/>

02:08:51 EH Trust: China- [https://web.archive.org/web/20120413171654/http://www.salzburg.gv.at/Proceedings_\(20\)_Chiang.pdf](https://web.archive.org/web/20120413171654/http://www.salzburg.gv.at/Proceedings_(20)_Chiang.pdf)

02:09:09 EH Trust: Russia- https://www.researchgate.net/publication/228104887_Scientific_basis_for_the_Soviet_and_Russian_radiofrequency_standards_for_the_general_public

02:10:23 EH Trust: India dropped their limits to 1/10 th pf what it was before because of this report <https://ecfsapi.fcc.gov/file/7520958381.pdf>

02:10:29 EH Trust: asl understand it

02:11:04 EH Trust: India published their findings as detailed here
<https://ecfsapi.fcc.gov/file/7520943486.pdf>

02:12:14 EH Trust: European Parliament reports address the issue of beam forming and measuring issues in this report
[https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/646172/EPRS_BRI\(2020\)646172_EN.pdf?fclid=IwAR3cD0TDOqGHpOmCWPnANN-Y6RBaa0eoQ4ZN0nuUwpVaLL8MIDtt6aKtiYM](https://www.europarl.europa.eu/RegData/etudes/BRIE/2020/646172/EPRS_BRI(2020)646172_EN.pdf?fclid=IwAR3cD0TDOqGHpOmCWPnANN-Y6RBaa0eoQ4ZN0nuUwpVaLL8MIDtt6aKtiYM)

02:13:57 Bruce L. Cragin, PhD: Don't confuse legislation with science!

02:14:11 EH Trust: European Report here also
[https://www.europarl.europa.eu/RegData/etudes/IDAN/2019/631060/IPOL_IDA\(2019\)631060_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/IDAN/2019/631060/IPOL_IDA(2019)631060_EN.pdf)

02:15:22 EH Trust: According to Belyaev 2019, “the health effects of chronic MMW exposures may be more significant than for any other frequency range.” The abstract states that, “Various responses to non-thermal microwaves (MW) from mobile communication including adverse health effects related to electrohypersensitivity, cancer risks, neurological effects, and reproductive impacts have been reported while some studies reported no such effects. According to Belyaev 2019, “the health effects of chronic MMW exposures may be more significant than for any other frequency range.” The abstract states that, “Various responses to non-thermal microwaves (MW) from mobile communication including adverse health effects related to electrohypersensitivity, cancer risks, neurological effects, and reproductive impacts have been reported while some studies reported no such effects.

02:15:36 lori: Thank you for all your work

02:16:59 EH Trust: Brillouin precursors can be formed by high-speed data signal as Microwave News 2002 pointed out “Introducing Brillouin Precursors: Microwave Radiation Runs Deep.” When a very fast pulse of radiation enters the human body, it generates a burst of energy that can travel much deeper than predicted by conventional models. This induced radiation pulse, known as a Brillouin precursor. Brillouin precursors can also be formed by ultrawideband radiation and, in the near future, by high-speed data signals.” The 2002 Microwave News article discusses the controversy over the Pave Paws radar system which used phased array radiation. In 5G communication systems, the phased-array antenna is one of the lead front-end components. <https://microwavenews.com/news/backissues/m-a02issue.pdf>

02:17:29 EH Trust: ““When a very fast pulse of radiation enters the human body, it generates a burst of energy that can travel much deeper than predicted by conventional models (Oughstun 2017). This induced radiation pulse is known as a Brillouin precursor. Brillouin precursors can be formed by ultrawideband radiation and by high-speed data signals as used in 5G.”found in <https://ieeexplore.ieee.org/document/9002324>

02:18:29 Augustinus.Ong: Thanks for the meeting.

VI. Important questions need to be answered for NH 5G Commission:

(Questions included in the minutes sent by D. Ricciardi to FDA and FCC)

From: "Shuren, Jeff" <Jeff.Shuren@fda.hhs.gov>
Date: June 24, 2020 at 4:28:49 PM EDT
To: Denise Ricciardi <dricciardi@bedfordnh.org>
Cc: OC Ombudsman <Ombuds@OC.FDA.GOV>, Patrick Abrami <abrami.nhrep@gmail.com>
Subject: RE: Important questions NEED to be answered for N.H. 5G health task commission

[External]

Dear Ms. Ricciardi,

Thank you for reaching out to me. I have forwarded your questions to the FDA's Intergovernmental Affairs Staff who handles inquiries from State and local governments. I have included Karen Meister, their Acting Director, on this email, as well.

Best regards,

Jeff

-----Original Message-----

From: Denise Ricciardi <dricciardi@bedfordnh.org>
Sent: Tuesday, June 23, 2020 10:38 PM
To: Shuren, Jeff <Jeff.Shuren@fda.hhs.gov>
Cc: OC Ombudsman <Ombuds@OC.FDA.GOV>; Patrick Abrami <abrami.nhrep@gmail.com>
Subject: Important questions NEED to be answered for N.H. 5G health task commission

Dear Dr. Shuren,

We would appreciate an answer to these questions regarding cell phone radiation. If you could number them one by one it would help with clarity of your response.

Regarding the FDA's report "Review of Published Literature between 2008 and 2018 of Relevance to Radiofrequency Radiation and Cancer" <<https://www.fda.gov/media/135043/download>> <<https://www.fda.gov/media/135043/download>>

1. Why did the FDA only focus on cancer as a health effect?

1. The FDA said of the National Toxicology Program findings that the FDA was unsure if the tumors were a causal effect or if these results were "due to weakening of the immune response due to animal stress from

cyclic heating and thermoregulation”Does the FDA think that cancer could be an effect of whole body heating, that cancer is a thermally induced effect? If so, what other studies show that heating causes cancer?

1. Did the FDA review in a systematic way the research on impacts to the nervous system?

1. At the Commission, a study on how millimeter waves interact with insects was discussed. Did the FDA review in a systematic way the research on impact to bees, insects and pollinators?

2. Did the FDA review in a systematic way the research on impact to trees and plants?

1. Did the FDA review in a systematic way the research on impact to birds.

1. If the FDA did not investigate impacts to insects or trees, what US agencies have done so?

2. The FDA website page Scientific Evidence for Cell Phone Safety <<https://www.fda.gov/radiation-emitting-products/cell-phones/scientific-evidence-cell-phone-safety>> <<https://www.fda.gov/radiation-emitting-products/cell-phones/scientific-evidence-cell-phone-safety>> has a section entitled “No New implications for 5G”. Does the FDA believe that 5g is safe or that 5G has the same health issues as 3 and 4G ? What is the FDA opinion on the safety of wireless?

1. What is the FDA opinion on FCC limits in terms of long term health effects. Does the FDA believe the current limits protect the public, children, pregnant women and medically vulnerable from health effects after long term exposure.

1. The FDA is aware that cell phone can violate FCC SAR limits at body contact on high power. The FDA has written that because there is a safety factor. What is the safety factor for the SAR the FDA relies on. At what SAR level above FCC limits will the FDA intervene?

1. What actions specifically is the FDA doing now in regards to 5G and cell phone radiation in terms of research review? How often will the FDA be releasing reports?

1. Will the FDA be evaluating the safety of 5G cell antennas? If so how? If not, what health agency is ensuring that 5G cell antennas are safe for people, wildlife and trees.

2. Cell phones and wireless devices emit several types of non ionizing radiation in addition to radiofrequency radiation. For example the devices emit magnetic fields and when a pregnant woman holds a laptop on her lap the measured fields can be high even into the baby. What agency ensures safety

related to extremely low frequency (ELF-EMF) electromagnetic fields- also non ionizing? Currently we have no federal limit, no federal guidelines and confirmed associations with cancer and many other health effects. Kaiser Permanente researchers have published several studies linking pregnant women's exposure to magnetic field electromagnetic fields to not only increased miscarriage<<https://www.nature.com/articles/s41598-017-16623-8>> and but also increased ADHD<<https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2763232>><<https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2763232>>>, obesity<<https://www.nature.com/articles/srep00540>><<https://www.nature.com/articles/srep00540>>> and asthma<<https://jamanetwork.com/journals/jamapediatrics/fullarticle/1107612>><<https://jamanetwork.com/journals/jamapediatrics/fullarticle/1107612>>> in the woman's prenatally exposed children. A recent large scale study <https://www.sciencedirect.com/science/article/pii/S0013935120303662?fbclid=IwAR11X_74FIT7y_RpO9WvbkE8AmAlBHAVU67yjkW8A6ZWPnPsLRioLxGsy1o#><https://www.sciencedirect.com/science/article/pii/S0013935120303662?fbclid=IwAR11X_74FIT7y_RpO9WvbkE8AmAlBHAVU67yjkW8A6ZWPnPsLRioLxGsy1o#>> again found associations with cancer. Please clarify which US agency has jurisdiction over ELF-EMF exposures?

1. Will the FDA be initiating any research studies on 5G and health effects?

We As a health study commission on 5G/ take these duties very seriously. We are unbiased and we are seeking all answers And facts. We are requiring your answers to the above questions.

Thank you,
Denise Ricciardi
Committee Member appointed by Governor Sununu.

The Right to Know Law (RSA 91-A) provides that Town email communications regarding the business of the Town of Bedford are governmental records which may be available to the public upon request. Therefore, this email communication may be subject to public disclosure.

V. Next meeting via Zoom: July 24th 9-11

Meeting Adjourned at 3:02 pm.

**NH COMMISSION TO STUDY THE ENVIRONMENTAL AND HEALTH EFFECTS
OF EVOLVING 5G TECHNOLOGY**

Meeting held:

7/24/20

9:00-11:00 am EST

Via Zoom (<https://unh.zoom.us/j/93912769762>)

Via telephone-US (+1 646 876 9923) ID: 939 1276 9762

In attendance: (12)

Rep. Patrick Abrami-speaker of the house appointee

Rep. Ken Wells- speaker of the house appointee

Kent Chamberlin-UNH-appointed by the chancellor

Denise Ricciardi-public-appointed by the governor

Michele Roberge-DHHS- Commissioner of DHHS appointee

Dr. Paul Heroux- Professor of Toxicology, McGill University- speaker of the house appointee

Rep. Gary Woods-speaker of the house appointee

Senator Jim Gray-president of the senate appointee

Senator Tom Sherman-president of the senate appointee

Brandon Garod-AG designee, Asst. AG Consumer Protection

Bethanne Cooley-CTIA , trade association for wireless industry and manufacturers

Carol Miller-NH Business & Economic Affairs Dept

Not present: (1)

David Juvet-Business and Industry Association

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Meeting called to order by Rep Abrami at 9:03 am

Abrami: For the sake of time, I am going to open the meeting. This is the New Hampshire Commission to Study the Environmental and Health effects of evolving 5G technology. I have a short version of something I have to say. Due to the Covid 19 virus and the Executive order signed by the Governor this public meeting is allowed to be conducted via Zoom. It is open to the public for viewing and was duly posted as a zoom meeting. With that said, if you are not a member of the Commission, can you please turn your cameras off and mute yourselves? That would be much appreciated.

I. Approval of minutes from 7-1-20:

The first order of business is the minutes. I sent them out about a week ago. By the way, Deb you did a great job of compiling them once again. I did get an email from Michelle asking for two corrections. I think we misunderstood for Augustus Ong, listed under attendees. Michelle was in attendance. Also, on page 29, "this was a very helpful discussion". Those are the changes that I have gotten so far. Were there any other changes? So without objection, the minutes are approved as amended.

II: Around the table member thoughts:

Abrami: The first thing we are going to do today is go around the room. The zoom room if you will. What we would like to do is talk about where we are at and the kind of recommendations, possibly that we would like to see in the report and where you stand on the whole issue. I am envisioning the room as it was at the State House and will go to my left. That means, Tom you are up first. Again, it's a general discussion and your thoughts as to where we are at and what we should be doing.

Sherman: Thank you, Patrick. I think I said it and it was in the minutes from last time. My overriding thoughts on this are that there is enough evidence to raise concern but I'm not sure there is enough evidence to show causation between exposure and specific health impacts. So, what the means to me is that there is more than ample evidence that a non-biased large scale study or studies needs to be done to demonstrate that we are not going to be implementing an entire system of communications that would put either human health or the environment at risk. I think of the Precautionary Principle. I also recognize we have several other examples where industries have said to us, this is safe. I can think of my own profession where we used to say, "Trust me. I'm a doctor".

I think we all know that phrase, trust by verify is the very least where we need to be. In this case, there is ample distrust because the Commission has already seen the amount of industry influence on the regulatory bodies. By the way, that's nothing new in Washington, DC or in some states. When I was in Virginia, our entire oversight for agriculture was from people who had formerly been in the industry. So when you think of some of the chemicals like glyphosate, people from the industry were regulating the industry and we know where that gets us.

My overriding New Hampshire response to this is, I would like to see the ability of communities to control their environment until such a time that an independent, scientifically based study or studies have been done to demonstrate the safety of this technology. I think that is consistent with Precautionary Principle of public health. I think it is consistent with the way many of us in New Hampshire view our personal freedom. And I don't believe we have ever been shown a compelling need to, right at this moment, on an urgent basis, implement 5G technology. I guess that's my summary statement.

My plea would be to have to start working on these studies and to ask our federal delegation, as they've done with PFAS, to start looking at where there has been exposure and what has been the impact. And start funding some of these studies at a federal level outside of the different regulatory agencies. I was really impressed by the consistency of response or I guess the consistent lack of response from the EPA and the FDA. It's amazing to me, that they seem to not want to respond even to a statutory state commission. So, I guess I'll close by saying the parallels to other exposures that we have, are really clear. And the lessons that we've learned from something like PFAS, where a few years ago, I started working on PFAS back in 2014. The industry knew about those dangers from the 1950s. They continued to profit with manufacture until at least 2003 when DuPont pulled out. 3m continues to and at this point, we have over a 100 communities and/or water systems in the state impacted and those are just public systems. Now we're playing catch up. But at the exact same time this week coming

out and Lancet are two, scientific articles looking at the data on PFAS and broadening the concern to diabetes, obesity, breast cancer. None of which, we have talked about on our way through this. So here we have an opportunity before the industry has an ability to expose us. To say, let's put the brakes on, let's get the data. You show us that it's safe in independent studies, not funded by you, but funded by an independent body and overseen by an independent body. And then we can move forward together to implement this new technology. That's my feeling I and thank you for the opportunity.

Abrami: Thanks Tom. I forgot to mention that once we're done with the round table, I'm going to ask Denise to just briefly discuss our non-response from the FDA in relation to the FCC. That is a discussion that we need to have. The other thing is that this meeting is being recorded, so everybody knows, It's pretty much for the ease of doing our minutes at the end for Deb. And that, any chat room discussions that are going on will become part of the minutes. We did make them part of the minutes from last meeting. Ok. Let's continue around the room here.

Wells: Yes. Thank you. In looking over the materials that we were previewing for this meeting, I came up with a number of recommendations, about seven of them. And it seems to me, that there are three levels of issues here. One is *general RF* radiation from Wi-Fi, 5G and all that. Then there *specifically 5G* and then on top of that, and I would give it the highest priority is the 5G *small cell antenna network*, which I think poses particular hazards. And I think that we should explore ways that New Hampshire can take unilateral action to protect our population, our environment, our forestry industry, and also supply the fastest broadband and communications to our population. I have a couple of things that I think would be worthwhile here. If this type of technology is to be developed, the state of New Hampshire could require that installers and owners of these systems carry enough insurance to cover the potential claims of New Hampshire residents who are exposed. We should require also insurance to compensate based on potential losses in the forestry industry, agriculture, hive losses, etc. Here's another separate issue. It occurs to me there's a parallel here with 5G and the mining rights in coal country where farmers found that they didn't own the rights to the mineral below them and their farms were turned into strips of gravel. I think it's a private property and liberty issue.

Broadcasters must be specifically granted rights for their signal to intrude on private property. And if they don't have those rights, they must not do that. Senator Sherman mentioned the problem that many of the studies, clearly there are conflicts of interest. I think that, that following the example of Jersey City and some others where they there's been a moratorium placed until, say, a UNH study is completed when that is not funded by industry, but where there's a demonstrable freedom from conflicts of interest.

Abrami: I guess there is some debate on whether Jersey City moratorium is in place or not.

Wells: Yes. I understand. I saw the petition that was circulated as a possible model. Then I wonder if the state of New Hampshire can impose its own maximum intensity limits and require that equipment have an accessible off switch if they're found to be out of compliance. And with that, I think I'll conclude my remarks and listen to what others have to say.

Abrami: Okay. That's very good, Ken. Thank you. There are some good points from both you and Tom so far.

Chamberlin: So as I listen to the previous two speakers, I'm in agreement. I echo their concerns. And essentially Sherman in particular, what you had to say is very much along the lines of what I feel both what you said just now and what's in the minutes. My belief is that we have a serious issue with exposure. The scientific data is pretty overwhelming. Although those data, the data is, is being completely ignored by the regulatory bodies. And that's kind of the elephant in the room here is we have a regulatory body that says that these standards set 30 to 50 years ago are acceptable. Yet the evidence, scientific evidence suggests that it's not. So that clearly is something that we have to address, explicitly in whatever report we have. Other issues, is the yes, we can ask for things like insurance. We can mandate that the providers have insurance to cover any issues that may come about as a result of this. The property rights, is also a good angle also.

But at this point, I don't feel like I need to see any more scientific evidence. I'm pretty convinced. Since I got on this, I'd been reading article after article and that's pretty convincing that yes, there's a problem. The one thing that we don't know that would be nice to know is the degree of risk. How much risk do you encounter by having a cell phone? being near a cell phone tower? We need to, to get that. And I think that we can and we should pursue something like a moratorium until we figure out and get answers to some of these very important questions.

As was pointed out earlier, this is not new. We have seen these types of issues. That is where industry just says it's no problem. This won't hurt you. We've seen that from smoking doctors, from the tobacco industry. We've seen from the fossil fuel industry dealing with things like climate change, which they knew 50 years ago that this would have an impact. So we keep seeing this pattern again and again. And what happens is that the industry makes an investment before we're able to find out or to demonstrate that whatever they're investing in, causes problems. And once they've made the investment, it's kind of hard to turn back, but I think that we have this opportunity now to just move forward to come up with moratorium so that they won't invest they won't get too much of an investment, won't get ahead of the curve as it were, before we figure out how much of a risk this imposes. Thank you.

Abrami: Thank you, Kent. Good points.

Ricciardi: I, too concur with everyone who has spoken. I think the one thing we can agree on all of us is that whether some of us believe it's unsafe and maybe some of us are uncertain. I think the biggest thing we can agree on is that there's a lot of disagreement in the scientific community. I feel that the science that we have seen and the evidence that has been brought before us and all of the materials we've been reading and speakers we've been listening to. I am convinced have a serious issue. And I really believe that it will harmful to just put this out. And I think we have to put stipulation on how things should be. I feel that the state could impose mandatory hard wiring for technology. In the meantime, continuing studies that are real studies. We're having a problem with the FCC. They haven't changed anything after all these years. It's a captive agency. They are a non- health agency. I made some

notes. We could as a suggestion, call for a halt to 5G and its infrastructure until RF limit has been set by federal health and safety agencies. There is no health agency overseeing any of this.

Again, state could call for wired infrastructure which is safe, and actually is faster. Not only that, it's safer in the ability to not be hacked. So, there are many measures there. We can call a halt until the scientists determine how the adequate methods of measuring should be. We can also pass bills that support further research for transparency and education on 5G and wireless devices to be used in the Internet of Things. In my opinion, it would be completely irresponsible for this commission to just blindly roll this out with all the compelling evidence. I don't want us to be like the PFAS or the tobacco industry. And there are some huge differences with this than anything else. If this is put in front of every other home, you are now robbed of your choice. You know, if you don't want to use a cellphone, you don't have to use a cellphone. If you don't want to live near a tower, you can look to where you want to live. This robs you of your choice. And that goes against our New Hampshire constitution. I have a full report on all of this, but that's sort of the gist of it. Do you want me to go right into segue into the questions that I've sent to the FCC and the FDA, or do that at the end?

Abrami: Why don't we do that at the end? I've got Carol Miller next.

Miller: Morning everyone. Here are my thoughts on this... I mean, the science is the science whether it's true or false, it's overwhelming. Every article that I've read, it's just overwhelming. But having said all of that, RF is RF. We've RF with 4G, 3G, Wi-Fi, whatever you name we have RF in our lives. And there are people who are sensitive to RF. And depending on the degree of RF they're getting it could cause the health issues or whatnot. We have some big challenges ahead of us. Cell services not regulated at the state level. It's regulated at the federal level. So I'm not sure that towns in the state can dictate anything to the Cell carriers. There are strict rules in place and we could be setting ourselves up for major lawsuits. So that's where some of my concern goes.

My recommendations really are more practical. And I agree with everyone else's recommendations that have been said so far. What can the industry itself, due to its devices and to its antennas and its system, to reduce the effects of RF to the public? Is there a technology that can do that shielding in phones that that creates less RF to the individual? And, and I think, it could be a costly solution for the industry. But if we're going to have any effect by, I think that that's where we really need to focus our efforts, along with all the other recommendations. Yes. Let's study it. I mean, it has been studied. We need to study it. Can towns literally put a moratorium on it? I don't know. Can the state say that everybody has to have a wired connection? I don't think so. So what we need to do is look at things that can be accomplished and through this committee, get that information out there. And I'll close my comments.

Abrami: Somewhere along the line over the over the years a left turn was taken. We were heading on the journey to fiber optics. And then then now we got, you know, the evolution of 5G. And we know fiber optics is actually more robust. They carry more information and they're less likely to be hacked if you will.

Miller: yeah, but that doesn't solve mobility problems. That's the lore that cell cellular coverage is. It's the ability to have your phone on you and your data anywhere any time. But that does not mean to say

that fiber isn't important. Fiber is the infrastructure of the future and where New Hampshire should be funneling any investments, or all investments, right? (I like the thumbs up) to fiber connectivity and stop putting band-aids on a sagging telecommunications infrastructure. I have very strong feelings about that. But cellular is a different creature altogether. It actually needs fiber to be able to transport data. e Everything comes into the wired network, even by cellular. So it's the mobility, the ease of use, it's the instant connection, instant reach ability that the mobile industry has captured. And so therefore, there needs to be some work on their part to abate all of this RF bubbling to the surface. And, you know, I agree with everyone else, but I just wanted to offer a practical solution or I guess sound check to what we're actually doing here.

Abrami: Thank you Carol. Beth Cooley, you are up.

Cooley: Alright, can you see me? Hear me? I am having some issues.

Abrami: I like those things behind you. Looks like Star Trek.

Cooley: Yes. I am in outer-space. Well, good morning everyone. I appreciate the opportunity to provide our thoughts at this point in time. You know, in terms of recommendations at this point, my thoughts are, I think we need more experts because everyone has been anti 5G at this point. And in fact, some of the "experts", their research on this topic has been called "junk science", quote-unquote. So my first recommendation and Rep. Abrami, you and I talked about this before the pandemic is Dr. Swanson didn't get to finish his presentation back in November. So I'm sure he'd be happy to answer questions because he ran out of time. I understand some folks may not agree with his point of view. But I think Rep Abrami, you and I discussed offline that we want a balanced approach to this commission. So that's sort of point one in terms of the experts in the science. I think the other side has some questionable credentials. Second, I think it would be helpful. We sent around, I think maybe three weeks ago, a recent study from the radiation safety journal on 5G a new study. I think it would be helpful to hear from the authors of that as well. And Rep Abrami, if you're open to it, I'd be happy to see if we can do some outreach to those authors. And that's sort of my first recommendation on the on the expert side.

I'm the first to admit I'm not an expert. CTIA is not an expert. We defer to those that are. We think we need to hear from the people that are smarter than us.

Abrami: Beth, I've always said to you, I'm open to hearing from all sides. And you gave us Dr. Swanson and he was sort of out of time, but we could probably dedicate some time more or any other experts that you may have.

Cooley: Yeah, that would be great Rep Abrami. And I want to say they're not, you know, industry experts. They're speaking their thoughts, their research. So I'd be happy to do that outreach.

The only other item I'd like to raise that I'm not sure that we've talked about. I think it's been distributed. But it's important to note that other states have done this. They've done the research and even your neighbors in Vermont and Connecticut have done this. And I think it's important to look at those recommendations. Other states like Louisiana, Oregon, Hawaii have also done reports on this as

well. So I believe some of those have been distributed, but I don't think we've talked about them. I know there have been a lot of things distributed into this group in terms of articles and studies. So I'd just like to highlight that other states are doing this too. And rather than re-invent the wheel, I think it would be helpful to look at what they looked at.

Those are sort of my two recommendations at this point in time. I appreciate a given me the opportunity.

Abrami: Well, Beth, if you have any documents from these other states that you could share with us, that would be fine.

Cooley: Absolutely.

Abrami: Okay. Well, thank you.

Ricciardi: Can I interject to make a comment?

Abrami: Yes.

Ricciardi: Okay. Since Beth did bring that up, I actually have in front of me what other states have done. And she referenced Hawaii. I can send this link out to everyone. Hawaii county planning board passed a resolution to halt 5G. Farragut, Tennessee has a resolution calling on state and federal governments to halt 5G until health risks are evaluated. The Washington DC advisory 3G/ 4G committee resolution opposing small cell wireless and 5G technology, wants studies confirming safety. I have a whole list here that does speak to what Beth just said. I'll make sure that committee gets that.

Cooley: Yeah, Denise, I think that's a good point to look at what other states have done, but I think it's important to understand the context. For example, in Hawaii county, the council passed the resolution this week. It's a nonbinding resolution. As you well know, it is illegal to stop infrastructure at the state and local level on the basis of RF, as that is regulated at the federal level. So the Hawaii county resolution that was passed is non-binding, and I believe Rep Abrami sent out our comments when it was before the planning board a few weeks ago.

Abrami: Yes I sent it out and I also want to know if theses have teeth or not. That's the question, you know, in the legislature we do resolutions to Congress and to the federal government but they're not binding to anybody other than it's a statement of a position. In this case, we have a commission that that's looked at this very closely. And that is a bit different than some of these other commissions from other states. I would say we have more technically minded people on this commission and then some of these other states may have, you may know more than I do about that Beth. Tom has his hand up.

Sherman: But I just have a quick question for Beth, you used the term "junk science". I was wondering which science you were referring to when you called some science "junk science".

Cooley: So this wasn't a quote from me. Another scientist called one of our previous speakers, research on cell phone RF issues, "junk science".

Abrami: Okay. Thank you. Okay, we will move on now. Brandon Garod.

Garod: It's Brandon, that's ok. It's a very common mistake. So I am a little bit leery at this point of continuing to hear from experts on either side because I think that we could call experts for the rest of the Commission. I think there is a difference of opinion. Some people think it's safe. Some people think it's not safe. I think there is enough evidence to suggest that it might not be safe that we should as a commission, have an obligation to flag that for the state. And you I don't think that hearing from more experts is going to move us in one direction or the other in terms of a commission deciding definitively yes, this is safe or no, this isn't safe. I think that there is some evidence it is not safe.

It is not, in my opinion, a foregone conclusion that this is definitely not safe, but if there is evidence to suggest that it might not be safe, I think that it is important that it is thoroughly vetted and tested before there's an enormous roll out in the state. And I think that's even more important, echoing what Senator Sherman said at the beginning, which is that there really in my opinion, does not seem to be immediate compelling need to have 5G in the state of New Hampshire at this point. My cell phone works great, almost anywhere I am. I can get on Wi-Fi, almost anywhere I am. We're able to meet as a commission remotely. We're able to do our jobs remotely. I'm not sure what the benefit is of having 5G if it's not thoroughly vetted and tested and confirmed, definitively, to be safe before it's rolled out. It would be great. You know, the faster things are, the better things work. Obviously, it's better for us moving forward technologically as a society. But at this current juncture, I don't see an immediate compelling need. I think that it's clear as a commission that we have some evidence that it's safe and some evidence that it's not. And now it turns to, you know, what are we as a Commission going to do in order to fulfill the task that we've been given as a commission, which is to make a recommendation.

And that's where I really struggle. Because like others have said, you know, I'm I think I'm the only lawyer on this commission. I spent some time doing some legal research yesterday and in anticipation of today's meeting. The Telecommunications Act of 1996 is very clear. The state cannot pass a law or regulation that prohibits the telecommunications infrastructure from coming into the state. It is preempted. It's completely regulated by the federal government. There's a carve-out for public health and safety but that is limited because there's a lot of litigation that has come from that in terms of whether that only applies to the state, or whether that can be attributed to local government as well, towns and municipalities. And overwhelmingly, for the most part, it's only the state that can pass a resolution that directly correlates to protecting the health and public safety. I don't think that the science is there in order for us to pass any sort of law that would prohibit or inhibit 5G, in order to say that it is in a direct correlation to protecting the health and wellness of citizens of New Hampshire. Any sort of recommendation that is passing a law or passing a regulation or a barrier to entry is going to be heavily, heavily litigated. And you know, whether it's successful or not, as, you know, is always an open question. But I think that to the extent that we decide to recommend any sort of legal barrier, we need to be prepared for that. That's going to result in a very long drawn-out legal battle.

I do certainly support any recommendations that we can make that are not likely to lead to extensive litigation that we may not have a leg to stand on. I think that the public needs to be made aware of the findings of this commission. I think that there needs to be more public awareness about the issues. And I

think the people in New Hampshire have a right to know about the science and about the studies that have been done. Anything we can do as a commission to increase public awareness even if it is like the Hawaii resolution. Yes, it's non-binding. But it's something. It's at least the community saying, yes, we have concerns about this. And this is what we're going to do to take the steps that we can in order to make people aware and to do our part to say that we as a community have concerns. And I think that is probably the sort of recommendations that we need to be looking at moving forward as a commission.

Abrami: Ok Brandon, that's great. When I speak at the end, I want you to react to one of the things I am going to say whether we even think it has potential of being a legal issue. So thank you. Michelle Roberge.

Roberge: I represent the department of Health and Human Services on this commission. We feel, where this is regulated at the federal level, that certainly more work needs to be done at the federal level to ensure that the standards are protective of public health. We know that the standard haven't been reviewed for a number of years. We know that there are a lot of studies that have come out and certainly more studies that we've heard, and what we're learning from this commission. More robust studies need to be done to ensure that they are protective of public health.

So we really need to make sure that at the federal level those agencies that include FCC, FDA, EPA really need to look at the science. I know there was a recent publication put out by FDA, I think it was in February 2020. They did look at number studies but didn't move forward with a standard review but again, more support of looking at those studies where they are not just looking at heat, but they're looking at other biological effect as well. The department at that point is supportive of that. And that's where we stand at this point. And I know there's other recommendations that are coming forth and that would be something we'd have to reevaluate as we pull the report together.

And I know Representative Abrami and I shared in an email that where we are, our role in this commission depending upon what recommendations that come out, being an executive agency put us in a conflict of interest situation if the legislature tries to implement any of the these, we essentially could be the body or agency that regulating it. We have to be careful of conflicts of interest. We definitely agree that more needs to be done at the federal level where it is regulated.

Abrami: I did respond back to Michelle's request or query about specific recommendations. And given that Michelle's representing the Department of Health and Human Services, there's concern whether that's an official position of Health and Human Services. When I chaired the marijuana Commission, we had a disclaimer that the recommendations in the report don't necessarily reflect the position of certain state agencies. So, I'll share that language with everybody down the road. We can take a look at that. And that's a problem with a commission when you have State agencies on them. They're between a rock and a hard place. That will go for the AG's office as well. They have to be careful. Their input is very valuable but it gets a little bit sticky once there are recommendations being made. Okay. Dr. Heroux.

Heroux: Yes. Thank you very much for the opportunity. I am going to propose some strong measures, but I realized that we have to avoid conflict with the FCC. I also realize that the measures have to be low cost and potentially reversible as well. So I think of this in terms of protecting various populations. So

first, to protect people from radiation from portable phones, I think that we should make it a law that cell phones do not work when they are held against the head, in other words using the proximity sensor. This is a simple alteration in software that when you put your phone against the head, it stops radiating. That means that you'd have to use your phone in front of you. So it doesn't change at all the functionality of the phone, but it practically eliminates the strong radiation to the brain. When you consider that the cost of assessing this SAR is from \$50 to \$200 thousand per phone. You eliminate a whole area of conflict. Of course, industry is not very eager for this because it reduces emphasis on the issue of heat from cell phones. But you maintain functionality. It's a very simple alteration. These sensors are already there and you eliminate connections with glioblastoma or auditory tumors. So that's one thing.

Now, to protect people from radiation from base stations, without making any comment on levels of radiation, I think that a 500 meter hold back and there was a distance should be should be that much. If you can deploy 5G with that kind of hold back, you know, fine. But we have data that shows that proximity to these towers is a health risk.

Thirdly, to protect young children, I think we should adopt the same measures that were adopted just a week ago in Russia in relation to wiring schools, limiting strongly the use of wireless, and forbidding the installation of base stations near schools. This is something that they have concluded to be a good idea on the basis of their most recent evidence.

Then to protect electro sensitive people, I think that we have to take measures that give them recourse, in terms of protecting themselves. I think that we should maybe train a few physicians in New Hampshire to become expert in this area so that they can confirm that some people are electro sensitive. And when they are confirmed, they would be entitled to some form of protection.

Lastly, it would be a good idea to protect citizens and businessmen because if in the future radiation becomes a stronger issue than before, some people who buy property might not be aware of the radiation levels on the property that they are buying. And they may face big losses as a result of this ignorance. So probably in New Hampshire, you already have specialists who are capable of assessing radiation. Maybe there should be some sort of framework that would make it practical for these people to give information on the levels of radiation in various places when there are transactions occurring. And in this way, you could build a picture of exposure in the state, as well as give these businessmen some form of protection. Thank you very much.

Abrami: Thank you, Paul. And Senator Gray.

Gray: morning. I am old enough to remember back in the late fifties when there was a big to do about high tension power line and cows that would be grazing underneath the high-tension lines. Since then, you know, we've done lots of studies on lots of different things dealing with the electro- magnetic radiation. Part of what's going on here, in my opinion, is that we have created a fear. People don't like change. And certainly if you have a fear of getting cancer, that is going to create strong emotion in various people.

I'm not saying that there are not people out there who are hypersensitive to RF. I am not saying there is no problem with RF. I'm saying that most of the data out there that we see needs a good peer review. And in some cases, those peer reviews that have been conducted, have pointed out flaws in that data.

There is a big problem when I hear, well, gee, the industry paid for a particular study and therefore that study should be discounted. I don't believe that to be, you know, what should happen. Like any other study, whether the industry pays for it or does not pay for it, it, you'd be peer-reviewed. And the results of those peer reviews would tell you whether or not there is validity in the study, whether this study should be questioned further on that. We don't have, and the studies that I've seen, and there's not that many good scientific studies out there. That is, a lot of these articles that we've seen go back and reference either the same studies or they are redone.

Let's go back. It's the fear of change that tends to make us believe that there is a bigger problem out there than I believe that there is. Having the ability, if I own a piece of property and say, you can't generate any RF signal that's going to come across my property, that's just never going to happen. Okay? That's like saying you can't use perfume when the wind is blowing across my property because of the smell the perfume. I mean, this borders on the absurd.

The photo that we saw with the tree and half of the foliage being gone and the cell tower there, I want to tell you that that there was a new cell tower put up and there were two trees next to each other. One of those trees had to be removed for the cell tower to operate properly. And you know what? It looked very much like the picture that we saw. So, you know, a lot of this information I would claim is anecdotal at best. The information needs a good peer review.

Right now, I don't know of any studies that are out there that have been using any of the technology that 5G employs with the beam forming and all that, which would in my opinion, tend to decrease the radiation that's normally being put out there. But we're not there. We're not in a place where we can make a recommendation. And when you have somebody have insurance for this or that, I don't particularly see that one either. I don't see that we have a good scientific basis to make much of a recommendation at all.

Abrami: Thank you, Jim. Here's what we got before us. I think municipalities would be looking for us to give them some guidance. That's at a level that this really plays out at. It's really cell companies coming into a city or a town and saying we want permitting rights to put on top of telephone poles or install new polls or small cells. I think the majority report really has got to focus back on the small cell towers because that's the issue, that's the 5G. And as I've said over and over again, 5G mean something to every cellular company. It is just a concept. Each interacts with 3G and 4G differently. And a lot of its proprietary, so we have no idea what's inside those antennas and how those antennas are configured. What we do know and we can measure once installed, is the power intensity coming out of those towers. But we should say that a town should be able to say yes, we'll allow you to put in a cell tower but want to be able to periodically measure the intensity coming out of those small cell towers. Gary, did you just sign on?

Woods: Yes, I did. I'm in Nashville and I don't know what happened. I saw the notice that Kent put out to start at nine. Then, I got a notice that it was cancelled. My apologies.

Abrami: OK. Well, let me follow through and we will give you a chance to weigh in. Okay?

So, right now the, the standard's at, let's call it ten watts per meter squared is the US standard. But some of the other countries have set the standard much lower than that. Australia is two watts per meter squared. Canada is three watts per meter squared, but we're way up to ten watts per meter squared. So, I would think at the very least, and I don't see why this would be a problem for us to say to the cellular companies yeah, if you install these, a municipality has the right to monitor the intensity coming out. And I don't know why cellular companies would have a problem with that. There's going to be a working group where we'll put it in a recommendation from for the next meeting that we could go one by one and have a discussion around each of these. All of the things that were mentioned today will be grouped and, and then we will have to as a group at our next meeting really have that discussion around each. But for today, we're just talking about ideas.

So again, this comment is for Beth. I don't know, why the cellular company would object to a town being able to measure what's coming out of those towers and having us have that part of the agreement with the town. If those towers are on our end are out of sync with what the standard is, then those towers have to be turned off, something to that effect. So that's just one thought.

And one that Brandon, I'm going to have you weigh in on too is I looked at the documents that came out from other municipalities of what they've tried to do. One states requiring permittees to defend and indemnify the municipalities from any liabilities arising from installation, operation and maintenance of small cell installations. But why would the cellular industry, if they feel this is safe, not be willing to sign off on a permit that that allows this? Because it's the town that's bringing in the cellular companies and the towns are going to be, why should we have our municipalities be unprotected if there is indeed damage? We, as a commission are hearing both sides of this. And there could be. It's hard to say definitively. We've all heard and I think everybody's kind of agreeing that there's evidence of potential harm. But cellular companies are saying, no, there's no harm. And the FCC saying, no, there's no harm. The FDA says, no, there's no harm. Well good. If there's no harm, then why hold our communities liable for damages? So that's, that's one that I think we should we should be talking about.

I think we should be pressing the FCC. That's my third point. As a statutory commission, as Tom points out, I would just stress with them why are standards set so high? We know there are no biological effects that play into this standard. How can Australia or New Zealand be at .5 watts per meter squared and successfully roll out 5G? They are going to roll it out, I would imagine, with a lot less power intensity. Remember, those towers are going to be at the height of the telephone pole. Most of them are going to be stuck on top of the telephone poles. We also know, as commissioners, that we see the push back going on around the country. You know the industry likes it or not, there are a lot of people looking at this getting the message out that there's this potential danger. So the public is aware of this and there's going to be push back for communities on town selectmen and other boards to deal with this. My fourth point, I agree with some of those that said that we should as one of the recommendations, which is kind

of a neutral recommendation that we would share this with the federal government agencies that a more robust study should be done on 5G. That should be pretty neutral.

Other communities have looked at simple ordinances and loopholes. How many streets are off limits? Now, I don't know how enforceable that one really is. But some communities have that, are trying to do that. Others have mentioned setbacks. I think Dr. Heroux mentioned that. There are towns that are talking about setbacks, a 500 feet from residences, businesses, schools. Again, that's something that that we could talk about. But if it's on top of a telephone pole in front of your house, you walk under the telephone pole and that's where the greatest intensity is going to be right by the pole. That's something that we will address.

Something that came up from the last speaker we had is requiring power density disclosures for renters and buyers, public buildings, locations where general public may go. That's something that I think we should discuss to see if we can make that into a recommendation of some kind. Another community was trying to say, let's have all poles with 5G antenna have warning signs that RF radiation is being emitted above. That's a simple thing. Again, I don't know why the industry would object to that. Some people would want to know that there's RF radiation being emitted above. So those are some of the things that we can look at as a group.

Brandon, in terms of the liability issue, do you have any comment on that?

Garod: What specific liability issue here you're asking about?

Abrami: Well, I'll read it again that some communities are requiring, permittees, meaning the cellular companies, to defend and indemnify the municipality for any liabilities arising from permits and installation, operation and maintenance of small cell installations. The point is to hold the municipality harmless if someone could prove that they were damaged from the small cell towers.

Garod: I think that to the extent that municipalities are making that a condition of receiving a permit, it would be a law or regulation that's specifically preempted by federal law. This is really where the rub is. The communities, the municipalities, the towns, the cities... they're the ones that control the permitting. You have to go through a permitting process and you have to be approved and any law that's passed, that is a barrier to telecommunications coming in that's passed by state, is specifically preempted unless you can meet one of a few carve outs. The carve outs create another barrier. Unless the state has specifically delegated to the towns and municipalities, the ability to regulate telecommunications in any capacity, that doesn't even apply. It's only the state that has the ability to use those carve outs as like a safe haven for a law that serves as a barrier for telecom. And I'm not clear as whether New Hampshire has delegated any of that authority to the municipalities. But there's a lot of litigation since this thing was enacted in 1996 and it's usually a municipality trying to pass something. And the way that the telecom companies are able to beat it is by saying that they're trying to say that it's for public health and safety or for consumer protection, or to protect right of ways. Those are the specific carve-outs. But unless this state has specifically delegated to those communities, you can't even use those carve outs as a defense. I think there's a good chance that it would be preempted. Really, I'm not an expert. That's basically what I've come up with so far.

Abrami: I agree that the state legislature would have to enable the municipalities to do that. Is that what you're saying?

Garod: If there was a specific delegation from the state of New Hampshire to the municipalities to be able to regulate telecommunications coming in, in any capacity, then the municipalities would have to show that any regulation that they passed, which served as a barrier to telecommunications coming in, fits one of the few carve outs under the Telecommunications Act of 1996. And in trying to find a good case to use as a standard, it's almost never been done.

Abrami: Ok, well, so that's why we have the AG's office is represented to give us those insights.

Sherman: Brandon, I have a question for you from what you said. Why do the telecommunications industries have to come in and get a permit if everything is federal? On what basis could a town deny a permit? So in other words, is the permitting process just a rubber stamp? If you don't permit, they're going to take you to court. You know, they can come in any way with or without a permit with or without municipal law, with or without state law. Is there anything that a municipality can do to stop the installation of these antennae and 5G technology?

Garod: To answer your first question, which I believe was, why would they need a permit? They might not under every circumstance. But imagine what the companies are trying to do is come into a town and build several new towers, to build several new receiver or to build infrastructure they would have to apply to the town for, you know, building permits or in order to do construction within the town. There are laws that determine what sort of process you have to go through in order to be able to come into the town and build something. If there is a specific limitation on telecommunications, being able to do that, that is passed by the town...that's specifically what is preempted by federal law. Because federal law determines when telecommunications can come in and what they can do. So it's frustrating because you would think that at the municipal level that would be who is in the best position to determine what's best for your individual town. I think what I can say for certain, I don't know if there's anything that can be done, but what definitely can't be done is any sort of regulation that amounts to any sort of barrier to telecom coming into the town and installing new infrastructure.

Sherman: So the follow-up would be if a town doesn't want 5G, they just deny the permit.

Garod: Well, I think you have to have a basis to do it. I'm not a local government guy, so I don't know.

Ricciardi: I can answer the question what Senator Sherman was asking. So the reason there is a permitting process is each town has zoning laws in place. And the telecommunications company, when they come into your town and they want to put a cellphone tower, they do have to show that there is a need and that this is the only location and that they checked everywhere else. So it does go before our zoning board here in Bedford. Everybody's zoning has different regulation. The zoning we have in place is not a barrier to the telecommunications, but it is definitive things that we have put in place that are allowable by law. So for example, we have the 750 foot setback from any residential neighborhood in our town now and was put before the voters and voted on. So there are things like that that you can do. The other thing that you can do that is legal, that we have just completed is a "wires and poles" town

ordinance. So we did not single out the telecommunications. We did not say this is just to keep the rules in place for them, but it is all utilities, wires, and poles. And in that section, there are some very strict but allowable bylaw criteria. If 5G were to come and it's beyond our control because the FCC, so we put allowable things in place. And when you do this, you're protecting the residents of your town. But you're making it more difficult, but it's across the board for all utilities. So by not singling out, then it can't be done. Anyone on our commission, and your towns, I'd be happy to provide a copy of what we just completed.

Abrami: Okay. Well, that that's something that I think would be helpful and that, you know, I think you have some specific recommendations that we're going to vet as a group in the next couple of weeks. Ken, do you have another leading question? I think Beth wants to respond. Would you mind if Beth responds?

Cooley: Yeah, I think the only thing I'd add to Denise's comments in terms of what a locality can do, technically, every locality should be complying with the FCC order that went into effect in January of 19. There could also be state laws as well. We've got 29 states and Puerto Rico that have passed laws that also need to be in compliance with their state law. But in terms of what Denise already outlined, localities also have say over aesthetics. In the FCC order, so long as aesthetics are reasonable, objective, and non-discriminatory. And that's what Denise was talking about when she was saying all utilities in the right away. That's the nondiscriminatory part. So in terms of an ordinance, that's also what you can outline is if everything in the right away is green, then we needed to be green and things like that. So just to piggyback off of what Denise outlined, that's how the process works. You do need to get a building permit. You can't just go in and build. Local governments also have the ability to deny a permit on the basis of public safety issues. So for example, if you're doing sidewalk work and the sidewalk is no longer wide enough for wheelchair that can be denied under ADA compliance. Public safety can also circumstance can also be where if a small cell would impede the vision of a driver around learner or a traffic light, things like that. So there's a process passing ordinances helpful to outline where control is retained in terms of the build out, but we'd also be happy to work with you. There are other communities in New Hampshire that have also passed small cell ordinances that we'd be happy to share. So thank you Rep. Abrami for allowing me to comment.

Wells: Looking at this as a physicist, it seems to me that there is an artificial distinction made between different types of RF emitters when in fact RF differs only in intensity and frequency and polarization and so forth. I'd like to see if we could get someone to look into why telecom is subjected one set of standards where say in FCC Class D, broadcast transmitter is limited to a certain number of megawatts per square meter at the property line. And so I think that this is something to look into. Why is there an inconsistency in what the power levels are allowed to be because the power levels on 5G are astronomically higher than they are for broadcast.

Abrami: We will see what we can do there. Ken, thanks. Gary, what we've been doing is everybody's been chiming in with some thoughts and potential recommendations to get the juices flowing here.

Woods: I have some thoughts thinking more as a physicist and where we are and our understanding of some of the basic processes or lack of understanding of the basic processes are, to me still troublesome. I tried to think of this in a number of dimensions. One of which is what I call the sort of the “arc of understanding”. This is a little bit of sidebar, but hopefully it'll all come together in a second. When we looked about the human body, we had gross anatomy, the dissected anatomy, microscopic anatomy, cellular anatomy, chemical anatomy, synthetic biology. Then we focus down and then we've got the genetic code with at all we got all the answers now. Well now we don't have all the answers even though you have the genetic code. We know there's now epigenetics and we're learning more as we go along. To me, we're at the sort of the almost gross anatomy levels with microwaves. We're still talking about the impact from what we call a bulk material, irradiate a mouse total and see what happens. And it doesn't give us an understanding of the potential mechanisms.

You say, well, why do we need to understand the mechanisms? Well, let's give an example of a tornado. Sort of normal atmospheric conditions exist and all of a sudden a tornado appears because you've got a very confluence of a lot of factors that come into play that can create an isolated event. And we see that in a variety of things where seemingly normal processes result in a very abnormal event. And we know how to look at that. Chaos theory from a mathematical perspective has done that. And I'm sure Dr. Chamberlain probably teaches courses on for what are called Fourier transforms, where you'd take seemingly very, very benign smooth waves, you put them together and you get this big spike. So these things that occur and we're at that point, from my perspective, of beginning to understand the confluence of these things at the molecular level. And so this arc of understanding has not come down far enough for my perspective, for me to feel comfortable.

And I think there is a line in the Cyprus thing that I thought sort of synthesized my thoughts. And it said “that the potential aggregation and dynamic interaction with other signals”. I think that's really crucial for us to understand. It's not just 5G coming in. And our last speaker talked about precursors, which is sort of the same sort of thing. You have a signal coming in and then it turns out it interacts and creates a different signal. And we'd make use of this in biology already in orthopedics. Being a retired orthopedic surgeon, we use magnetic pulsed impulses to enhance bone healing. And that's you're creating a field at the molecular level. Because we know our bone is basically what's called a piezoelectric material and it depends on electrical currents to do its job and stay strong. That's why you go up in space. You don't have gravity, that piezoelectric phenomenon doesn't exist. And you'd have bone loss. But that's an example of the kinds of interactions.

Epigenomic part is another example. And a lot of these processes, and we touched on this very briefly when the issue of proton tunneling came up. That's at an extraordinarily low energy level and secondary internal processes make that occur and change all the time. And we know that things, simple, things like the configuration of an enzyme is a configuration of proteins in general. It is highly dependent on these hydrogen bonds, which are susceptible to proton tunneling. And as a consequence, all these processes we have, we really don't have an idea of how these work and some of the secondary processes. We're back up the “arc of understanding” at the bulk material level. And until we can get further down. And we will eventually, but to me, we're not there yet. So I just wanted to offer that as a concern, At least from my perspective, a concern of where we are in terms of the science. And I'll leave it at that.

Abrami: That said. We don't know what we don't know. Thank you for dialing in from your vacation. Everybody's had a chance to weigh in. And what let's talk about next steps here. What I mentioned, the last meeting, I think we should form a work group to take these ideas. I asked for volunteers. I got Representative Wells, Dr. Chamberlin, Denise Ricciardi, Carol Miller, Dr. Heroux, and myself that will meet as a work group, to at least put some ideas on paper. We threw a lot of the ideas around here today. We have to do, as a group is take each one of those ideas and see if it will pass muster as a recommendation in our report. And so that's what I think what we'll do. I will work with those people and set up a meeting to do that and then maybe have to meet once or twice before our next meeting. We're running out of time now. We have three months left. I did say I was going to try to follow up to see if we get an extension on the date, but because we go to the next Legislature, I think they really want us to have our report out by November first. So that's what we'll continue to shoot for. So any objection to what I just said? I think that we've got a small work group that will work on this and put recommendations on paper and will get that out to everybody.

And at the next meeting we'll go through each one of those and have a discussion around each one of those to see if there's support for it or not support for it. And having the discussion, some of the discussions we just had, the science discussions, but also the legal discussions as to what we can make work for municipalities. What message we want to send to the federal government about this delegation or other ways.

Sherman: I just wanted to remind everybody, you know many of us have served on many commissions and committees. And I believe if there is a dissenting view to whatever the majority wants, there is the capacity for Minority Report. Is that not correct?

Abrami: That's correct.

Sherman: So I'm just saying that not because I'm encouraging a Minority Report, but because for people who haven't served on commissions or members of the public, the goal is to reach some level of consensus, but perhaps not unanimity. And, and so we may end up with two reports and that's just the way Commissions work.

Abrami: Yes. I think I mentioned that the past. Yes. That's the way commissions work. Okay. Which brings us to Denise. I want you to just weigh in a little bit on the lack of the response to nonresponse response we got from the FDA.

Ricciardi: So I sent several questions to the FDA and the National Cancer Institute regarding answers that are very important to this commission and our decision making. The questions were ignored at first. After I kept at it, I got a response that was not an answer to the question. I point blank, asked and numbered the questions and said we need an answer to each question not linked to their website that we already know that we already have. That's very frustrating. And that was the situation on both counts with the FDA and the National Cancer Institute. So I tried to reach our United States senators offices and finally yesterday I spoke with a staff member in constituent services. And I have forwarded our questions to that office. And I feel at this point, it's going to take our U.S. senator to insist they answer the questions. And I find it very telling that they don't want to answer them. We are a

commission with a very important task and I don't understand why they want to answer these questions. I'll give you an example. I'll read one of my questions. The FDA is aware that cell phones violate the FCC SAR limits at body contact on high power. The FDA has written that because it's safety factor and that's what they do. What is the safety factor for SAR the FDA relies on and at what SAR level above the FCC limits will the FDA intervene? So they have written that that it is not safe on body contact, but then they don't do anything about it. And why will they answer one simple question? That's just an example. So that's where we're at. I'm still waiting.

Abrami: Tom, I'm going to ask you to help us out with that and try to get maybe Senator Shaheen or someone to help us out with that.

Sherman: I am happy to.

Ricciardi: It's her office that I spoke with. It wouldn't hurt to have you follow up as well.

Sherman: I can call their state directors. I reached out to them about the FCC and we didn't get anywhere. It's not because they didn't try but because they didn't get a response. It's frustrating.

Abrami: So if, if the commission doesn't mind, you all remember Theodora from Environmental Health Trust. She had reached out to me about the FCC and if you don't mind if we give it a few minutes and then Beth, if there's anybody on this that from the industry that wants to respond, we will give them that opportunity as well. So if you don't mind, we'll have Theodora spend a few minutes. We have about a half hour left.

Scarato: Thank you so much. I had sent over and just wanted to make everyone aware of the documentation that I received from the EPA with a lot of questions. Their response to my questions was that the EPA's last review was in 1984 in terms of biological effects and they gave they cited that you should all have a copy of the questions and the answers. Just to go over what the EPA said. I said what's the research? Has EPA reviewed the research on damaged memory? They say they don't have a funded mandate for radio frequency matters. And in regards to the birds, bees, and trees, what's really important is that the limits were not set of course for birds, bees or trees and the EPA seem to confirm that in the answers that they sent. Also in regards to the safety factor, I would note that I think this is a really important question, so I'm glad it's being asked because it said that there's a 50 time safety factor. But when it comes to phones against the body, is certainly couldn't possibly be a 50 times safety factor for that in terms of the heating effect. So want to make sure you have that as well as the scientific letters that were sent to the FDA in regards to their report, their literature review on only cancer. They didn't look at other end points comprehensively. And you'll notice that Dr. Albert Manville, the former fish and wildlife lead, who is now retired, wrote stating that the current FDA statement is irresponsible, unfounded, and sets a dangerous precedent and so on. But please take a look at those letters that were sent by the scientists regard to the FDA. So thank you.

Abrami: Thank you. I think I did send that out to everybody. And if I recall, each response to each one of those was "that's not our mandate"Something like that. Is that correct? Right. So we have got it because Congress has mandated us look at this, something to that effect. Again, next steps are going to

be getting the working together a couple of times. In terms of the next meeting, we could try to put a stake in the ground and come up with a date while everybody's on the Zoom meeting here. Are people on vacation? Are they staying local? August 28th? Who cannot make August 28th at 09:00 AM? Brandon can't. I want to make sure the Working Committee has enough time to do what they have got to do.

Sherman: I'm on vacation on the 28th, but I can do it anyway. I could do Monday, the 31st if that worked. I don't mind dialing in. It's no problem.

Okay. Okay. How about Monday the 31st? Anybody can't make money to 31st? Okay, why don't we save that date, the 31st at 9 am. I'm going to reach out to the folks who volunteered and we'll come up with some dates for us to get together in between. So well, we've got about 25 minutes. Is there any other general discussion we would like to engage in? If not, I'd like to open this up to any other folks on the on the Zoom meeting that our guests, if they'd like to weigh in. I would allow that now because we have time. Does anybody else want to weigh in? Questions? Comments? suggestions?

Bloede: Yes. Oh, can I speak? I am Paul Bloede from Coloradans for Safe Technology. We had a meeting recently, Zoom meeting with an attorney that I wonder if your organization is familiar with this national level Attorney. His name is Julian Gresser. And he had a lot of comments about the legal state around the country of this whole issue and I thought he was very incisive and we have a transcript now with his presentation to us, we have that transcript just from last week as a PDF file. I didn't know if that would be of interest. How I could get that file to any of you, should that be of interest?

Abrami: Can you get that to me?

Bloede: Yes. Do you have an email address?

Abrami: Yes. Use abrami.nhrep@gmail.com.

Bloede: Yes, definitely. I will get that out to you. I think you will find it interesting hopefully.

Abrami: I'll get it out the others. Okay, thank you. Cece?

Doucette: Thank you Rep Abrami. When I first started investigating the wireless radiation issue, I thought as soon as we saw that it's especially harmful to children, that my school would have jumped up immediately and shut off the wifi in schools.

Abrami: Cece, why don't you back up and explain your involvement in this.

Doucette: Okay. I spent several years at Ashland Public Schools in Massachusetts doing fundraising for what we kept hearing our kids would need to succeed in the world. And that was basically the 21st century classroom, which is an industry campaign to introduce wireless into our school systems. And I had spent many years doing fundraising because our town didn't have the budget for that. I started looking and an engineer friend of mine tipped me off that there could be harm. So I started my investigation and I came up with a few studies that were saying no harm. I didn't understand at that point that "no harm" is not the same thing as "safe", right? So I started looking a little bit deeper and

then I start finding peer-reviewed studies all over the world showing great biological effects. And the set of studies that got me on my feet were the sperm studies, where they've taken male human sperm and expose it to a laptop with the antennas on. And it changed the DNA, it slowed the motility in it cause far fewer sperm to be viable in just four hours of exposure.

We had just bought my youngest daughter a laptop going into high school. And of course she's using it right on top of her reproductive organs. So that was the day that I got involved in this. I have helped introduce legislation here in Massachusetts and I wish we were as swift as New Hampshire is. My bill has been in play for six years. There are others on the utility smart meters that had been in play for eight years. But even during this pandemic and the racial justice movement that's happening, our legislature is finally advancing three of our bills, so we're hopeful that that will happen here.

Early on in my journey, others who talked to me about legal action and I don't know anything about that. I didn't want to see lawsuits come into play. I just wanted us to do the right thing and especially protect our children. But then I got to listen to a conversation with somebody who was referencing Martin Luther King Jr. And what MLK was teaching us is that in order for important societal changes to happen, it happens through three channels. 1. The public gets educated and speaks up and thank you to Deb Hodgdon for being the catalyst in New Hampshire who then spoke to Rep Abrami, who then drove down to my kitchen table here in Massachusetts. We had a long conversation about wireless. 2. There is legal action that happens to hold those who have infringed upon our rights, accountable. 3. Public policy ultimately catches up with the science or whatever else the issue is. So as much as it makes me uncomfortable to think about legal action, it's part of how change happens.

So to our Attorneys General, I hope you will look at this as seriously as you looked at tobacco and do the right thing, reach out to your colleagues and other states, get this conversation going. My understanding is the industry has already set aside billions for the lawsuits that are going to happen. But we cannot afford to continue to expose our children even during this pandemic, handing out hot spots without any information on how to use technology safely. So I implore you as a mother, as a woman who fell down this rabbit hole which I never wished to be in. But once you know the harm, you can't "un-know" it. And we have to use every resource that is available to us to start protecting our children, especially right now. So thank you for your time. I hope the commission will report out favorably something that we can hold up with pride and say, thank you to New Hampshire for being our nation's leader. And then we can follow suit in our states too.

Abrami: Thank you, Cece. Is there anybody else that would like to weigh in at all? Okay. I don't see any. I guess we will be adjourning. We will see everybody on August 31st at 9. And then, in the meantime the subgroup will be meeting. Did I mention that we're recording the meeting? I thank everybody for your time. Thank you to those who have tuned in from afar. Those on the Working Group, I will get an email later today with some dates that we can get together. Okay. Is there a Motion to adjourn?

Woods: I was the latest but I will make a motion to adjourn.

Abrami: motion to second by Carol. Without objection, we're adjourned.

V. Next meeting via Zoom: August 31st 9-11

Meeting Adjourned at 10:43 am

Text chat during Zoom meeting:

00:30:12 Bruce L. Cragin: ???

00:30:45 Bruce L. Cragin: ???

00:41:30 Bruce L. Cragin: Yes bring back Swanson!

00:43:58 Cece Doucette: Hawaii County Council just passed their 5G ban

00:45:51 Bruce L. Cragin: Ha

00:50:10 EH Trust: There have been attempts to overturn the Telecom Act section 704. Some links her e<https://ehtrust.org/policy/the-telecommunications-act-of-1996/>

00:51:17 christine.melkonian: YES, to public awareness

00:54:54 Cece Doucette: It was our state attorneys general banding together and suing the tobacco industry that finally brought the toxic effects mainstream. Perhaps the Commission can recommend that NH lead an effort for attorneys general to band together on wireless too, which if successful, would help to provide the funding to put safe, fast, sustainable technology in place. I believe NH still receives funding from the tobacco industry lawsuit today.

01:01:20 EH Trust: Also the Telecom Act Research continues to show effects from power lines. See studies here <https://ehtrust.org/science/research-on-magnetic-fields-extremely-low-frequency-electromagnetic-fields-cancer-and-miscarriage/>

01:02:08 EH Trust: Many countries have protective limits in regards to power lines, over a dozen. They set limits at the level linked to cancer in children. But the US has no limit at all. <https://ehtrust.org/policy/international-policy-actions-on-wireless/>

01:02:29 Bruce L. Cragin: Exactly, Sen. Gray. So much fearmongering.

01:03:56 EH Trust: Two published studies by the Ramazzini Institute “Carcinogenic Synergism of S-50 Hz MF Plus Formaldehyde in Rats” (2016) and “Life-span exposure to sinusoidal-50 Hz magnetic field and acute low-dose γ radiation induce carcinogenic effects in Sprague-Dawley rats” (2016) found that ELF exposed rats had statistically significant increased incidence of several type of malignant tumors when combined with a known carcinogen.<http://onlinelibrary.wiley.com/doi/10.1002/ajim.22598/full>

01:04:44 Bruce L. Cragin: And here comes some more ^^

01:12:17 Bruce L. Cragin: Re. A., you're hearing ONE sde, not both.

01:33:08 Bruce L. Cragin: Physicians are not physicists.

01:33:27 Ken Wells: Bruce: This one is

01:33:48 Bruce L. Cragin: You, Ken? or Gary?

01:34:08 Ken Wells: Dr. Woods

01:34:35 Bruce L. Cragin: Thabk you. I will contact him.

01:37:54 Bruce L. Cragin: <http://bobpark.physics.umd.edu/WN10/wn121010.html>

01:39:17 Bruce L. Cragin: Sorry, I meant <https://quackwatch.org/related/signs/>

01:44:10 Bruce L. Cragin: <https://americanbeejournal.com/why-we-shouldnt-fear-5g/>

01:45:48 EH Trust: The FDA scientists letters are found here <https://ehtrust.org/doctors-slam-fda-report-on-cell-phones-cancer-and-health-effects/>

01:46:04 EH Trust: Dr. Manville <https://ehtrust.org/press-statement-from-dr-albert-manville-on-the-fda-report-on-cell-phone-radiation-2/>

01:46:38 EH Trust: The EPA letter can be found here <https://ehtrust.org/epa-birds-bees-trees-5g-wireless-effects/>

01:47:05 Bruce L. Cragin: "FDA scientists" or activist scientists?

01:47:24 EH Trust: The letter from scientists to the FDA.

01:47:42 Bruce L. Cragin: Yes that's more honest.

01:47:49 EH Trust: NIH scientists, experts internally signed, several on the world health organization emf group

01:50:20 EH Trust: Several of the scientists are expert advisors to the World Health organization who are asking the FDA to retract their flawed report on the studies.

01:54:13 christine.melkonian: YES

01:54:20 Bruce L. Cragin: I give up. You people are just lost. The idea that a commission of legislators has the scientific capability to meaningfully question the standards is ridiculous.

01:54:26 EH Trust: Resources on Wi-Fi in School <https://ehtrust.org/wifi-in-schools-tool-kit/>

01:55:14 Ken Wells: Aug 31 at 9am

01:55:47 christine.melkonian: Thank you so much

01:56:28 Cece Doucette: Thank you to the commission members and others, please feel free to reach out if there is anything I may help with. c2douce@gmail.com

**NH COMMISSION TO STUDY THE ENVIRONMENTAL AND HEALTH EFFECTS
OF EVOLVING 5G TECHNOLOGY**

Meeting held:

8/31/20

9:00-11:00 am EST

Via Zoom (<https://unh.zoom.us/j/95489344931>)

Via telephone-US (1 312 626 6799 (US Toll) ID: 954 8934 4931)

In attendance: (12)

Rep. Patrick Abrami-speaker of the house appointee

Rep. Ken Wells- speaker of the house appointee

Kent Chamberlin-UNH-appointed by the chancellor

Denise Ricciardi-public-appointed by the governor

Michele Roberge-DHHS- Commissioner of DHHS appointee

Dr. Paul Heroux- Professor of Toxicology, McGill University- speaker of the house appointee

Rep. Gary Woods-speaker of the house appointee

Senator Jim Gray-president of the senate appointee

Senator Tom Sherman-president of the senate appointee

Brandon Garod-AG designee, Asst. AG Consumer Protection

Bethanne Cooley-CTIA , trade association for wireless industry and manufacturers

Carol Miller-NH Business & Economic Affairs Dept

Not present: (1)

David Juvet-Business and Industry Association

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Meeting called to order by Rep Abrami at 9:05 am

Abrami: Due to the Covid 19 virus and the Executive order signed by the Governor this public meeting is allowed to be conducted via Zoom. It is open to the public for viewing and was duly posted as a zoom meeting. With that said, if you are not a member of the Commission, can you please turn your cameras off and mute yourselves? That would be much appreciated. In addition the meeting is being recorded as an aid to doing the minutes. All chat room discussions will be included in the minutes.

I. Approval of minutes from 7-24-20:

I have not received any comments or changes to the minutes. Are there any changes? Without objection, we approve the minutes from that meeting.

II: Proposed report format/ Procedural Discussion:

Abrami: We also sent out a copy of the agenda and the proposed final report format and recommendations the work group has been working on. That's the primary reason for the meeting is to talk about those and if there are any other recommendations. This is what I am thinking about the report: Preamble, Definition of Terms, Physics, Study process (who we heard from, etc.), then a section of the questions posed by the Commission in the legislation and the answers, our recommendations.

What we consider firm recommendations for lack of a better word and also listing some other things that we decided not to make recommendations. There will also be appendices and supporting documentation for the recommendations and of course the minutes will be attached to the report. This is what I am thinking but I am open to any changes. Are there any questions on that?

Cooley: Rep Abrami, just one question on that. In the outline, where would a minority report or dissenting opinion fit it?

Abrami: I will double check this but it's a separate report that gets attached to this report. I know there will likely be a minority report which is fine. I will get clarification on that. It was easier when we were at the state house and I could just walk over and ask but I will get clarification on that. OK?

Cooley: Yes, thank you.

Abrami: There is a work group that consists of seven members: Carol, Denise, Gary, Ken, Kent, Paul and myself. There are seven of the twelve members that have been active. The working group met three times. We started with a baseline of ten recommendations and we have done several iterations on these. Obviously, these are open to discussion today whether you think they should or should not be in the report, etc. Since I sent these to you I have gotten two updated versions that I sent to you this morning. Sorry it was late. One is from Paul with some minor changes. One is from Jim with some major changes. Hopefully, you have seen them.

Sherman: Pat, I also sent some minor edits to Paul's version this morning.

Abrami: ok. I didn't see those. So can you chime in when we get there? What we will do is take them one at a time and have a discussion around each one. I had a communication with Beth about, do we really want to take a vote on these today given that you have just received them this weekend. What we can do is take a straw poll to see where we are on each one of them and not be an official vote. When we do a final vote on these, if the majority votes yes, it will be in the report as a firm recommendation. If not, then it's not. After that, we will have a vote on the report with everything in it. There are twelve members that are active, so if it ends up 6-6, I will have to figure out what that means.

What I would like to hear from you today possibly three things. 1. I like it the way it's written. 2. I would like to make some changes then I could support it. 3. No matter what, I don't think this recommendation is needed. Certain members of the working group took charge of certain recommendations so I will ask them to describe the recommendation and what the motivation was behind it. If there are any other recommendations please let us know in this meeting and we can deal with those.

Sherman: Before we go to Recommendation 1, can I just make a comment on the first paragraph?

Abrami: Sure

Sherman: This is a great sentence but it's very long. On the last one it says ", thus the commission ..." I think it would be clearer if you had a period and the words, "given these considerations, the commission yields". My feeling is that it's fine but I would have the last sentence be independent. That's in my edits for what it's worth.

Abrami: I get it. That's a good one.

Wells: I submitted an edited version of this one and changed it into a bullet list.

Abrami: ok. Boy, I am behind in my email. I missed that one too.

Miller: Which document should we be looking at? The original and everyone can chime in with their changes? I have multiple versions open and I don't know which one I am looking at any more. I think the one that you sent was Revision 3. Correct?

Abrami: Yes. If you see red in there, that means there were changes.

Sherman: which one did you send?

Miller: It was Revision_3 5G Recommendations.docx

Gray: since we are commenting on the first paragraph, I took out a couple of different things in my revision. I think that whoever puts this thing together at the end should consider removing and only presenting facts and not things that aren't facts.

Abrami: What you are saying is that the things that you crossed out aren't factual.

Gray: Right. You talk about the whole insurance industry, well that's not true, ok? The insurance industry if you leave it like that is more accurate. In the next sentence down you say "because of" instead of "due to potential harm". Thank you.

Abrami: I agree with those. These are good ones.

Gray: The word "determined" is used many places. In my edits part of my suggestion is that we take that out and replace it with the word "believe". The definition of determined is that it's found to be a fact or conclusive. In the first paragraph of the report we say that none of this is found to be a fact so again... take that word out and replace it with believe or a word of your choice. That would be a good revision.

Sherman: If you are anticipating a Minority Report, then wherever you have "the Commission has concluded" should be changed to the Majority or this Majority of the Commission has concluded... because you are going to have a Minority Report that has not concluded that necessarily. I think you will be a little more accurate using that phrase in the Majority report. That's only if there is going to be a Minority Report to recognize that the entire commission does not agree with this report.

Abrami: That's a good point, Tom. I anticipate there is going to be a Minority Report.

Gray: I will write it.

Abrami: Ok. So we are going to have a Minority report. Anyone who wants input into it can send me their comments.

Roberge: I haven't had a chance to talk with my leadership from DHHS on any of these recommendations so I may have additional comments from a resource perspective once I have had a chance to look these over with leadership. Also, I know we talked about this at the last meeting about not formally taking a position on the recommendations just due to the role of the department. I think we would just want to have a statement in the report reflective of that.

Abrami: right. It will say effectively that the recommendations do not necessarily reflect the position of any agency, Attorney General's office or Dept of Health and Human Services.

III: Work group recommendations and discussion:

RECOMMENDATION 1- Propose a joint resolution of the NH Senate and House to the US Congress and Executive Branch to require a review of the current radiofrequency (RF) standards of the electromagnetic radiation in the 300MHz to 300GHz microwave spectrum, used to measure exposure and health study to mitigate the health risks associated with the use of cellular communications and data transmittal, promulgated by the Federal Communications Commission (FCC).

Cooley: With the whole caveat that I received these Saturday morning and have not spoken with my members or with legal dept. so that will be my disclaimer throughout all of this discussion. My one question about this recommendation.... The first sentence of the last paragraph that says, " this commission believes that EMR is on the path to be confirmed as a class I carcinogen, where does that information come from? Is there a footnote? How is that assumption being presumed?

Miller: Recommendation 1 is a merger of something that I had written and Paul had written. That particular phrase came from Paul. Can you speak to that?

Heroux: Essentially that would refer to an article by an epidemiologist Anthony Miller who is very active with IARC. In other words, IARC has agreed to review the situation and in the last report what was missing was animal evidence and its likely there will be an upgrade to the classification because you have two major studies NTP and Ramazzini that now provide animal evidence.

Abrami: We need to refer to the papers either as a footnote or in the appendix.

Cooley: I think a footnote, Mr. Chair might be helpful because this is someone who has not presented before the Commission. I don't know who they are and it's the opinion of one person. I think backing up that claim or allegation would be helpful.

Abrami: The gist of recommendation 1 and I don't know Beth, why your organization would not think it's a good idea saying that we do have more to study. That's basically the thrust of this. There are a lot of organizations asking for this. Carol, why don't you spend a few minutes on this.

Miller: This is a joint resolution of the New Hampshire Senate and House to the US Congress and Executive Branch just requiring a review of the current RF standards and asking for a health study. The un-highlighted text is just back up and could probably be moved to the appendix. I don't know if anyone has any questions about that particular recommendation. I think it's pretty straight forward.

Sherman: I thought the recommendation was fine. It was straightforward but I thought there was a clearer way to describe what we are trying to get done. The edit that I suggested would read: "Propose a joint resolution of the NH Senate and House to US Congress and Executive Branch to require the FCC to conduct or commission a review of the current RF standard of EMR in the 300Mz-300GHz microwave spectrum as well as a health study to assess and recommend mitigation for the health risks associated with the use of cellular communications and data transmittal". I just think it's the active which makes it clearer than passive.

Miller: So you are suggestion after the word "require" to put the "FCC" right there.

Sherman: yes and after the word, "spectrum" I would use the words "as well as a health study to assess and recommend mitigation for the health risks associated with the use of cellular communications and data transmittal".

Miller: I am ok with that. Anybody else have an opinion about that?

Abrami: That's fine with me. Does anybody have a problem with that?

Gray: Again, I have made many changes in my edits and I don't object to many of the words that Dr. Sherman has put forward but I still think the rest of those paragraphs need to be looked at. When I read this report for the first time, it was very clear to me that someone who was a very big proponent of eliminating 5G or wifi, entirely, wrote this thing. That's not our job as a commission. I encourage you to take a look at my edits. I tried not to gut your proposals but to make it more neutral while still putting forth your proposals. Thank you.

Abrami: The work group will be meeting again on Friday. We have got our work cut out to try to pull all of these together. I am sure some of your words are going to make it into the report, Jim. The bigger question right now is who is opposed to having a joint resolution where we say that more study is needed on this topic? Who is opposed to that? We can tinker with the words.

Gray: I am not opposed to having a study but I want you guys to know that the reality of having a joint House/Senate Resolution is practically nil. The Senate has these resolutions and has determined that it's

better for the citizens to go out individually contact their Congressmen than to do one of these resolutions.

Abrami: It is our understanding on the House side that the Senate doesn't like joint resolutions. We were trying to give it a little more umph. No matter what we do, it will be a sell to whether it's just the House, where we will have to get 201 members to agree to it. We thought it was important that as a commission that at very least, we make a statement that further study is needed, bottom line. Having the full House and Senate would give it more umph than just the commission.

Ricciardi: I want to make two statements if I could with all due respect to everyone. I am going to speak for the seven of us on the working group. I don't believe any of the six of you are against technology by any means. We are for it and we presented solutions that are safer, quicker, better latency. I don't appreciate that we are called out as saying we are against it. That's simply not true. I've got my cellphone right here ok? I want to clear that up right now. We are not against it. We are against the way it is now and we have shown a better solution as you get down into the recommendations.

The second thing is, we are tasked with a job based on the findings that we found. We don't sit here and not put them forward because the Senate or the House won't go for it or we didn't do our job. Our job is to present the truth. You don't, not present the truth because you are afraid of the outcome. The truth is the truth. You place it there and see where it goes. The seven of us with the testimony, the evidence and the science came to these conclusions. Anyone else who disagrees is allowed to and I respect their opinion and they can follow up in a report. But I do think we should get through it so we all have a good sense of where we are at. I am going to reiterate this. It is unconscionable to not tell the findings because you are afraid it won't sit well with someone or won't pass. That's my two cents.

Abrami: Thank you, Denise.

Sherman: Pat, I have a few edits on the paragraphs following recommendation one if this is the right time to mention them and they are minor. The words "living things" at the end of the second paragraph. I would replace that with "organisms" which is a slightly more scientific term for living things. The Obama-Biden plan to combat cancer, I am concerned about including that if it was never adopted by any elected body. If it was 2008, was that a campaign plan they had in 2008 because certainly the FCC would not be held to any campaign plan. My recommendation would be if it was adopted, then include it but if it was a campaign platform, I would delete it and just have the first one which was the National Cancer Act.

Miller: I am ok with that. I didn't write that particular piece.

Abrami: I think Tom has a good point, Paul. Was that ever enacted?

Heroux: I am trying to find out what type of formal approval this had but I think I should do it later.

Abrami: yes. Please do it later.

Gray: Sometimes these things are done by Executive Orders. But the paragraph ahead of that, where you talk about the FCC, all needs to be restructured also. Rewording that so it flows much better is something that you should consider.

Sherman: I agree with Jim on that wording because rather than have the word “favorable” in that paragraph with the Ninth Circuit Court, I would use what Jim said which was what the ruling was and what it will result in. I haven’t seen Jim’s version of this but I would favor being as clear as possible. The word “favorable” leaves a question as to who is it favorable to? Is it favorable to the FCC or the plaintiff?

Abrami: Carol, I am looking at you.

Miller: I am ok with removing that and I am not that invested in the surrounding documentation and it should probably be moved to the appendix. With regard to this, there is a lot of information in there and I think it just muddies the water.

Abrami: Ok, you heard all the comments Carol to modify.

Miller: If people send their recommendations directly to me, I am happy to do that or its going to get lost in the shuffle. I have Senator Gray and Senator Sherman, who else had comments?

Cooley: I just had a footnote on the article by Anthony Miller.

RECOMMENDATION 2- Establish a State position that protects the State and all its Municipalities from any liability from harm caused by small cell antennae placed on the public rights-of-way. Specifically liability of the State of New Hampshire and its municipalities connected to harm caused by claims of personal damage or harm from the deployment of 5G small cell towers or the attachment of 5G antennae on telephone poles, electric poles, lamp poles, or other structures on the public right-of-way is by state statute transferred to the Federal Government. The Federal Government shall be required to defend and indemnify the municipality from any liabilities arising from permits and the installation, operation, and maintenance of small cell installations.

Abrami: We had some discussion about this. This had to do with protecting our municipalities from harm. Do we really want this recommendation or not because the feeling is that it will put citizens in a bad position. I actually originally wrote this and Paul took it from there. Our communities are being forced to deploy small cells at telephone height and I thought about holding them harmless. This was an attempt to protect our municipalities, but what about people?

Heroux: Well, this is a rather legal question. I think we all recognize the motive of Rep. Abrami's original statement. But, if the federal government cannot be sued and if this recommendation goes nowhere, what is the means by which we can support municipalities and individuals who might feel helpless in relation to this problem in the sense of congealing their actions together and make sense of it and rationalize it.

Woods: It seems as a discussion, we went over this very point and the complexities of having a liability element in there as a recommendation. We wanted to include it but perhaps put it at the end as an observation. And couch it in terms that we understand that this very well may be an issue that will come to the fore that we did not have a recommendation but wanted to recognize that this is an issue that will perhaps need to be addressed in the future.

Abrami: right. I put in my notes...discussing whether to demote to something less than a recommendation.

Sherman: Brandon is with the AG's office. Could we get an opinion whether this is even possible? What's happening is states and municipalities are being asked to approve these but based on FCC rulings, they don't really have a choice. As a result, if the people of the town are harmed, and go after the municipalities because they can't go after the federal government (FCC) then they are stuck. I am concerned that municipalities will bear the brunt of liability without being able to say no to the request from the cellular company. Do we have any wiggle room on this? Or is it something that is not worth mentioning because there is nothing we can do about it? Can Brandon weigh in?

Garod: I'll do my best with the caveat that gets into the question of what is civil negligence and what establishes the liability for civil negligence. That is pretty far outside the realm of what I typically do in the consumer protection world. But, I had two initial thoughts when I looked at this. Because municipalities are being forced to this and don't have a choice. To bring a suit for negligence there has to be some sort of negligent action like setting aside the standard of care. If they are being forced, I don't know how a community could be held liable for that. If they did have an option and did not do their due diligence and allowed this to happen, that's a different story. It's very clear that other than aesthetic regulation, the placement, design, size of something in a public space, municipalities have no authority to say no to 5G technology being moved into their town. I don't think there is a huge risk of liability for municipalities.

When I went back to the legislation, and looked at what the commission is supposed to do, I think this is a bit of an outlier. I think it may be worth mentioning that there are concerns about who would be liable. I don't see anything in the commission's tasks as to what steps we need to take legally protect municipalities or the state from possible liability. It's more getting the information out there, developing strategies to limit exposure, public policy statements rather than developing a plan to protect municipalities from liabilities.

I think that likely if there are lawsuits in the future, that they will be directed at cellphone companies who are pushing these things out aggressively without doing their research and they have acknowledged the risk of harm as they recommend not putting it near your head but if they are then

going to implement towers everywhere and not give anybody a choice, that's really their choice. I am not sure that their choice and actions can be imparted onto municipalities that don't have an option and trust the FCC that they are doing what they are supposed to be doing about safety. Those are my takes.

Ricciardi: The seven of you know that I have been against recommendation 2. I feel it's a dangerous recommendation and we should omit it. State government needs to make these antenna safe not indemnify or protect government from liability or responsibility when they allow them to be deployed unsafely. We need state government to say no to these transmitters and challenge legal cases around Section 704 of the 1996 Telecommunications Act that prevent them from even considering health and safety. I don't think we should have Recommendation 2 in there at all.

Abrami: My original thought on this one is...the new twist is that these antennas are going to be in the public Right Of Way. In the back of my head I'm thinking there is something different about these being in the public Rights of Way. We have two, the municipal and the state ROW. We have town roads and state roads. So, that's the game changer for me. That's what's different about this. We have no control of those antennae and what's coming out of them. I am okay with eliminating #2 or demoting it.

Sherman: The real problem here, as Brandon said is that the municipality and the state can only object on the basis of aesthetics. We should be asking our federal delegation to bring legislation that would allow or expand the ability of municipalities and states to challenge the placement of 5G/small cell technology based on concerns about health risk. That is getting to the meat of the problem here. The reason that #2 exists is because municipalities and states have no ability to challenge FCC ruling on the basis of health risk. To me, that's the crux of the problem. What needs to happen is we need to allow local control with regard to health concerns for this technology. Local and state governments should have some regulatory impact on whether or not this is rolled out.

I can't believe that the FCC can do this without any consideration of health impact. I would change #2 or I would change the concern to: the Commission will write a letter to our federal delegation urging them to bring federal legislation that would expand the ability of states and municipalities to object to implementation or placement of 5G/small cell technology based on their concern for health risk. That's the way I would take this, rather than going down the liability corridor which gets us into the issues that Brandon was talking about.

Abrami: Right, the courts are not reviewing whether it's good or bad. They are just following 1996 statute.

Sherman: Frankly, if the industry wants to bring Xenon ray guns out that transmit data quickly, they can do it if the FCC says they can do it. The FCC has the power to say, you have no right to object to whatever technology that the telecommunications industry brings forward based on health risk. That's it. That's the problem.

Heroux: what the FCC says is that certain levels of electromagnetic radiation and power density are not harmful. It has a stranglehold on that because this was a main preoccupation of the engineering community. It also says that you have to provide telecommunications service. But these two

requirements leave a lot of ground for other arguments. I think aesthetics is a very weak word to describe the leeway that you actually have. Without confronting the FCC, you can probably do lots of things.

Chamberlin: My point is that we might want to wrap #2 into #1 since they are pushing for basically the same thing having our federal delegation become involved in changing the policies for objecting to cell tower placement.

Abrami: that's a possibility. Also, I should have mentioned this earlier. We had a discussion in the working group about even using the term 5G but broadening that to a certain bandwidth of RF because 5G may be passe in a year or two with 6G. 5G is just a marketing concept. It's being rolled out differently by all of the cell companies. Some are using small cell towers and others aren't. I don't want to burden this here but we are looking for words to use in the report that would be broader than 5G.

Sherman: I would fully support that.

Wells: I agree and I can write some language about that.

Abrami: #2 won't stand the way it is and we will take a crack at it by either incorporating it in #1 or coming up with some additional language here. Basically, the change that would have the most impact is for the U.S. Congress to act. We all know that. That's a tough one. There are bills filed every once in a while but they tend to go nowhere at the federal level but as New Hampshire we will throw our two cents in. Or at least the Commission will.

RECOMMENDATION 3- Require the New Hampshire Department of Health and Human Services or other New Hampshire agency to include links on its website that contain information and warnings about RF-Radiation from all sources, but specifically from 5G small cells deployed on public rights-of-way as well as showing the proper use of cell phones to minimize exposure to RF-Radiation. In addition, public service announcements on radio, television print media, and internet should periodically appear, warning of the health risks associated with radiation exposure. Of significant importance are warnings concerning the newborn and young as well as pregnant women.

Chamberlin: the part that we were most recently looking at in our subcommittee is an establishment of a registry that would be on a website. The reason for that registry would be for people to log their concerns. How I became aware of this being at the University in electromagnetics, a number of calls from concerned citizens get routed to me. I tell them what I know about exposure to electromagnetic fields and they are sometimes concerned that they don't have an avenue for reporting their concerns. I tell them that there is not much they can do about exposure at this point because of the 1996 Telecommunications Act and so they are stuck. Where do they go? Do they go to the FCC? That doesn't seem to be a very productive avenue. I feel by having a registry, we can get a sense of how many people

are concerned in the state of New Hampshire and to build essentially ammunition if there are a lot of concerned people so we can go to the federal delegation and have them do something.

That's the second part that I really addressed and that is have a registry where citizens can report concerns so we can get a sense of how many people do have concerns. If it's only one or two then maybe the point is moot but if we are getting hundreds that's something that we should know. Paul, did you want to address the other aspect of this?

Heroux: You are right. We wanted to give an access point to monitor this situation and the access point could be for either individuals or organizations or a separate access point for both of these.

Gray: This is Jim. This recommendation first of all should not be for the Dept of Health and Human Services. It should be for the state because we don't care what department it is as there may be a better place to put it. It's more realistic if you have the state collect data. What we are talking about here is a man year of effort and supervision and if the volume is high, maybe more than that. That would be a budget issue and again, do we really want that and will the legislature approve it?

Abrami: we know most of these will have to go to the legislature for approval but first someone has to file the bill. Those discussions will happen there. We decided that we want to make the recommendations and let that process work through.

Chamberlin: I have done websites like this and to provide information and add links as we have done with the website associated with the Commission. In terms of a registry, it could be something as simple as a survey. I have created those in an afternoon. We could create a survey that is appended to the website. I think we are talking about a man week as opposed to a man year worth of effort.

Heroux: I echo that comment because with automation today, it's fairly easy to create a link and a person from within the state can access this link and file a pdf document automatically. If you have many requests then you might face the labor of assessing these requests but as Kent pointed out, you wait until you have many and then you know it's worth it. Thank you.

Roberge: As I said earlier, I have not had the opportunity to talk with leadership about this so I may have some additional comments. One thing that I thought of and it's been talked about a little bit here is funding for this. If the department is required to do a registry, there are obviously database requirements and an evaluation component. One thing that concerns me is that if we are collecting this information, at this point, we don't have any authority to do anything with it. That's somewhat concerning to me because if we are collecting all of this information, what is the dept doing with it? I know DES has been mentioned, I am not sure if they are appropriate either.

I know DHHS has a radiological program. It's a small program that is focused on ionizing radiation. We license and inspect sources of ionizing radiation including x-ray machines in dental offices or hospitals or industrial radiography in industry or a radioactive materials program. Again, that is focused on ionizing radiation. The department also participates with Homeland Security Emergency Management and an emergency response program specifically for Seabrook Station. Again, it's ionizing radiation. I'm not sure

that DES is the correct agency. That being said, any additional requirements to do inspections, monitoring or in this case PSAs and things like that, there is a funding mechanism that would be an issue. If you had a registry, what are you doing with that data? Is it confidential? Will there be private health information if people are talking about radiation sickness? How involved are we going to be with these activities?

Also, I am not sure where the PUC falls in any of this. They do regulation of power lines so the radiological health program does not do power lines. That falls under the Public Utilities Commission. I am not sure where Telecommunications falls and if that would fall under PUC or not. I just wanted to offer up those thoughts and certainly I am going to take this back to my program and I may have additional thoughts to share at a future meeting or through email.

Abrami: It is my understanding that telecom is not really regulated like the utilities because it's not considered a utility.

Sherman: I have a few thoughts. We have a commission to study environmentally triggered disease and we have been working on this kind of database on that commission. We have been disrupted by Covid and it's a senate commission so we have not been allowed to restart but what we have learned is DES has a site where private property owners can put their well test results in. I don't believe that required legislation or if they did that through rules. Individual well owners could enter their data into the site and make it possible for DES to develop a database for private well owners.

There is also on the public health side, and Michelle knows there is an entire infrastructure of public service and the ability to generate public service announcements. One concern I would have is with well testing you have a certified report from a well tester. But with this, if you have people self-report with what is on their digital read out on their EMF monitor that has not been verified. I would be concerned about any agency being compelled to report non verifiable data. Just a few thoughts but this might be something we could take up with the environmentally triggered disease commission. There might be a softer language to recommendation 3 and I agree with Jim that we should not say which departments would do this because it could be one of several departments.

Abrami: My concern is what data? What are people reporting? It's one thing if it's data but just feelings? I don't know we have to be careful.... feelings based on what?

Chamberlin: We will talk more about data collection in another recommendation but for this one, this is just a way for citizens to say I don't like the way the current legislation exists, Section 704 of the 1996 Telecom Act. Whenever people hear about it, they get very concerned about it because there is nothing they can do because of this legislation. How many people are concerned would be helpful to us as we move forward. If only a handful of people go on this registry and register a complaint, that tells us one thing but if we have hundreds then that tells us something quite different. It would only be so people who register could have their voices heard. Right now citizens who are concerned have no place to go. They can write letters to the FCC as I have and very likely nothing will happen. This just makes it a state initiative to identify people who are concerned so we perhaps can do something.

Roberge: Is this appropriate for an advocacy group? I don't know that it's an agencies responsibility to survey the feelings in New Hampshire. I would want to go back and talk to my leadership about this. Any data that we hold, we would have to make sure that the data is safe and valid. I just wonder if it's more something that an advocacy group would take on.

Abrami: Michelle, after you talk to your leadership, can you just drop me a note so I get a sense of where they are?

Chamberlin: So, actually the registry was an add-on to the first part which is a website that contains information about exposure to electromagnetic fields. This is informational and the add-on is to assess how many people are concerned. So what about the first part does this seem to fall within the purview of your organization?

Roberge: Before I make any comment on that, I would want to talk to my leadership. Right now, we are knee deep in Covid, as you know. I would want to talk with them and I can come back and share with this group what I learn.

Abrami: We have another six to go through and we have forty five minutes so we are going to move along.

RECOMMENDATION 4- Require every pole or other structure in the public rights-of-way that holds a 5G antenna be labeled indicating RF-Radiation being emitted above. This label should be at eye level and legible from nine feet away.

Abrami: Basically, with antenna being in the public right of way, I thought it wouldn't be a bad idea to have the poles labelled to that effect as they may be on telephone poles or light poles, etc. Current towers are usually surrounded by barbed wire fence or some structure around it at the base with a sign saying....don't climb the fence. Obviously, there are different reasons for that. That's all this is, to label the pole. Beware of the device on the top of the tower. Industry would have to label the poles. Can we open that up for discussion please?

Cooley: Just more of a comment and again, I still have to talk to my membership and my legal department. There are other entities in the public right of way that also use low level non ionizing radiation. So, I question if this is discriminatory. In the public right of way, you do have utilities, electricity lines and you also do have the cable industry deploying micro-wireless facilities also using 5G. Again, I have to talk to my members and legal and I wonder if this is a discriminatory practice should the commission endorse this in the majority report.

Abrami: So what you are saying is any device in the public rights of way emitting RF should have this sign. That way, it's not discriminatory. Is that correct?

Cooley: I don't know. I will have to speak with my attorney. I flag that as a concern. There are other entities in the right of way and this is targeting one.

Abrami: Brandon, do you have any comment on this one?

Garod: It's close. I think it's dangerous to apply if it only discriminates against one type of entity then it's definitely preempted. That's actually contrary to what the Portland case said. In the Portland case, they found that different types of restrictions can be applied to different types of infrastructure. Really, the key takeaway is if the effect of whether something discriminates against a particular company of particular type of infrastructure would have the effect of prohibiting their entry into the state to provide services, then that would be preempted. But, if it's simply requiring a certain type of infrastructure to provide a warning that is consistent with the type of radiation that is emitted by that type of infrastructure and placement of that type of infrastructure, I think there is an argument that could be made that that is permissible and wouldn't be preempted.

All of this is sort of fuzzy. I think that is in line with the court when the court prohibited the FCC from regulating too broadly a state or municipality's ability to regulate aesthetics that may be discriminatory against one particular entity but as long as there is a reason for it and it's not prohibiting their entry, I think there is an argument that can be made that it may not be preempted.

Sherman: I agree with Beth in a way. If there are multiple devices emitting RF, we should not have that warning limited to the telecom. Maybe the warning should read that there is an RF emitting device on this pole, no matter what that RF is. We know that cell towers look like. Right now, we don't know what 5G or small cells look like and we may not recognize that that emission is occurring from that pole. Rather than being specific about the industry, we should be specific about that which we are trying to protect the public from which is this level of RF exposure and that would get around Beth's concern. If it's a cable company or telecommunications company or wireless company, the point is to identify that that exposure is occurring.

Gray: The first thing you need to say is who is responsible for putting the sign up there. If it's the owner of the antenna, you need to say that. Second, your problem with this recommendation is that you go back to your preamble, nothing has been proven about the health effects so you are talking about potential health effects. Do I have to put a warning on the side of my house because it has a transmitter that transmits my water usage and electric usage to people who go by? Again, this needs to be looked at carefully because it could be a whole lot of impact if it's not done right.

Abrami: That's good, Jim. Thanks. I will take a crack at modifying this one and we will talk about it again.

RECOMMENDATION 5- Require that schools and public libraries migrate from RF wireless connections for computers, laptops, pads, and other devices, to hard wired or optical connections within a five-year period starting when funding becomes available.

Wells: This is mostly about schools and public libraries where the environment has already been fitted out with wifi. There is strong evidence that the RF associated with wifi might have greater impacts on young children. The Precautionary Principle would indicate that alternatives to RF would be preferred. Two possibilities would be to go to hardwired connections to every device or use a different frequency range and go up into the optical range where there are not likely to be any health effects to that. One of the things that the state of New Hampshire could look into is that classrooms could be fitted out with a device like Lifi which is an LED lighting fixture based optical data transmission. We need to look at how we fund this but Carol recommended one possible fund may be the FCC's E-Rate program for telecommunications and IT for schools and libraries. We figured if funding was procured then five years would be a reasonable amount of time to complete a project.

One thing that I think is an important point to note is that the optical means for data transmission is much faster than RF. So, essentially you would be saying, let's just skip RF and 5G and go into the next generation directly.

Gray: Certainly the opposition report on this one would be that if you link it to funding, and implementation, you take out the word, "require" and its better and the schools will do it because you are paying for it and its better. I don't have a major thing on this except the word "require".

Abrami: So just encourage schools and libraries to look at alternatives including Lifi.

Gray: you would want to put in there that when public funds or whatever funds are available.

Abrami: right. The reason we put about the funding in there is that schools have spent a lot of money putting this infrastructure in place and it would take a lot to reverse that course. Hardwire is an option but Ken's suggestion of Lifi and our understanding at this point, is that it wouldn't be an expensive option relatively speaking.

Wells: It appears that Lifi would be plug and play. It also involves an upgrade to a more cost efficient lighting. You might actually come out ahead on this. We would have to look into what the actual costs would be and savings but there is a possibility it would offset quite a bit of the cost with energy savings.

Gray: Just as a caution when you put something in your report that you don't have to do it until the funding is available, you are already that it's not that bad. Certainly, the cheaper that you can make it would mean that a parent of a child that is sensitive to electromagnetic radiation, could fund the conversion of one classroom or whatever. Just think hard about this one if you go forward with it. What if your data from studies proves that it's not harmful, then mandating is the wrong thing to do. In my example, the funding will dry up if the radiation is not harmful.

Wells: The E-Rate funding is not tied to harm. It's tied to telecommunications and IT in schools and libraries. But it's a good point you raise about taking federal out of the description of the funding. It is possible that you could get a charitable donation to convert school buildings. That's a good idea.

RECOMMENDATION 6-Establish new protocols for performing signal strength measurements in areas around cell tower radiators to ensure compliance with regulatory radiation thresholds and to evaluate signal characteristics known to be deleterious to human health as has been documented through peer-reviewed research efforts (e.g.,[1]). Those new protocols are to take into account the impulsive nature of high-data-rate radiation that a growing body of evidence shows to have a significantly greater negative impact on human health than does continuous radiation. The measurements should be taken in regions surrounding the tower that either are occupied or are accessible to the public. Commissioning measurements are to be performed when the site is installed and at regular intervals if required by state statute or municipal ordinance such as those required by the town of Burlington, MA [2]. Measurements should also be collected when changes are made to the tower that might affect its radiation, such as changes in software controlling it. Measurements should be performed under worst-case scenario conditions when the site is transmitting at its highest levels.

Abrami: One thing as a state that I think we need to know is.... if these antenna generating RF are even generating within FCC guidelines? This recommendation talks about what the state should be doing about this.

Chamberlin: This recommendation really has two parts. The first is to come up with new protocols for performing the measurements. The way we measure RF right now is the way we have been doing it for 50-60 years. It averages signals and does not take into account the summative effect of having multiple transmitters. One thing the FCC guidelines do not take into account at all and that is, in the last thirty years think of how many transmitters have been added to the RF spectrum. Now we are not being illuminated by a single source like a local tv station. We are being radiated by cell towers, our own cell phones, wifi and the way that measurements are taken now don't take the summative effect of those radiation sources into account. The first part of recommendation six takes that into account and prescribes a different way of performing these measurements. Also, what's being found is that it's not the continuous radiation that has the greatest effect on us but it's the transient nature and impulsive nature that has the greatest deleterious effect on health. The way this is worded, takes that into account and specifies a new way of doing measurements.

The second part says, you have to make the measurements and I could find no evidence that a cell tower ever has to be measured unless maybe there is a report of someone thinking the radiation is too great. The FCC doesn't have a commissioning for cell towers. I am familiar with this from working with the FAA. Any time you install anything, you always have a commissioning measurement to make sure it's performing according to specs. The cell industry from what I have read has basically made calculations about what power should be radiated from certain antennas and they say these calculated powers are below the FCC threshold so we are good. However, I know from experience that you can get what is called terrain or building focusing of electromagnetic waves that gives you far greater signals than you would expect from simple calculations. The second part of this says whenever you commission a facility, you have to go and make measurements under worse case scenarios and you have to do it using the new protocols.

Just basically wanting to make sure that the towers are putting out the types of power that have been calculated and that those powers are below the FCC thresholds.

Wells: Thank you, Kent. That's really excellent. I would make one suggestion though. When you talk about focusing by buildings and terrain, could you also add beam forming?

Chamberlin: You mean beam forming from the antennas? I wasn't sure how much detail I should go into but I am thinking when you set up a test protocol, you specify the beam forming will be at the location of the receiver. It's actually buried in the worst case scenario statement.

Wells: right. I was just thinking that you acknowledged that the radiation can be focused by buildings and terrain but it can also be focused deliberately.

Chamberlin: I will add that in. Thank you.

Roberge: I just had a question in terms of implementation of this recommendation. How do you envision that? Is that something that the cell phone company would do after installation? Do you envision a reviewing body of that or an independent analysis? It is unclear to me how this would be implemented.

Chamberlin: I was thinking it would be a third party or some independent measurement organization, perhaps even the FCC.

Roberge: I come at this from a regulatory standpoint. If you put a requirement out there and a measurement happens. It's fine if it all works out great but what happens if the measurement comes in and it's not consistent with what requirements are or is it a true requirement? Or is this just a recommendation? It's challenging to implement something like this if you don't have a true standard and you don't have consistent measurement protocols. What happens if it's above? Who will be the authority to make corrections or enforce? If you are thinking of this from an enforcement standpoint, for instance if this cell tower measures above, what happens then? From an implementation standpoint there can be challenges with that.

If you are thinking of implementing this as a licensing or commissioning and enforcement of it then there would be a cost associated with it establishing a protocol program whether it's on the federal level or state level. Who is the regulating body for that? Just a couple of thoughts there.

Abrami: We talked about this. We can get lost in the weeds on the detail. This isn't words or legislation. For that we would have to have a lot more detail than what you see here. We are saying we need a better protocol and the state has the right to ask for an independent person to measure at the worst case scenario that it's within FCC standards. This is not trying to change FCC limits on this. I understand asking, who do we go to if it's out of compliance. It could go to the courts. Either this is a good idea or it isn't a good idea. To me, this is a good idea. I don't have a comfort level that the industry is taking into account all the other towers and RF soup in the area that they aren't really above the federal limit.

What we are saying as a commission is, we think it's a good idea to use an independent body to measure and if it doesn't pass the test, then we as a state want to say you have to turn that tower off. Now they may come back and say, it's not our tower, it's the one down the street. These are the discussions that should be done at the federal level but it's not. We need to move forward with this recommendation and then the detail comes in if someone picks this up to write a bill where we would add more detail on some of the things you are bringing up Michelle.

Chamberlin: I can make this really brief. Cece linked in the text chat with some certification requirement from Burlington, Mass. I will read that and see if I can add some of what they have done to our recommendation and move forward with that.

Heroux: Actually, this kind of a situation has been taken into account in the past in relation to the tops of buildings where you have forests of radiating structures and this is why advanced equipment that has frequency analysis capability was created. If these locations exceed, for example thermal limits, there is a requirement that says you have to have a power intensity reduction. But it has never been taken into account for the general environment outside these facilities. Essentially, because it's assumed that outside this region there is no hope that you will ever reach thermal levels. But if you are taking into account crest measurements and peak characteristics, of course the situation can change very substantially.

RECOMMENDATION 7- Require that any 5G antennae located on a public right-of-way or new cellular phone antennae of any type, be set back 1,640 feet (500 meters) from residences, businesses, and schools within a municipality enforceable by the municipality during the permitting process unless all owners of a residence or business or a school district waives this restriction.

Abrami: We went back and forth of this one in the work group. I will let Paul explain.

Heroux: Essentially, here there is no desire to challenge the FCC on power levels. There is no desire to challenge the availability of wireless services. There is just a desire to have these towers with a setback from dwellings where people live or work.

Gray: Your 500 meters is .31 of a mile. The recommendation doesn't take into consideration anything about the transmission, what the power level is at any particular point along that .31 of a mile. I went to look up the things that were listed there and found it very difficult. It took me to Google Docs. I looked also at our webpage to find them. Again, I think if you are going to include something like this then you need to start getting into more detail. But a third of a mile would eliminate cell antennas. There are an awful lot of people you can pack into a third of a mile.

Cooley: Again with the caveat that I need to discuss this with members and legal department. I do think there is an argument that can be made that this violates section 332 of the Telecom Act. That is, you are trying to tell providers where they can and cannot site facilities which could have the effect of impeding service thus increasing the cost and providing a barrier to entry. You are saying where we can and cannot go which has been ruled as a defacto moratorium and has been ruled unlawful. Again, I need to run that up the chain but that is my initial impression.

Wells: this is a section where we need to make a distinction. It is referred to as 5G and we need to have an RF definition. The thing that is unique about 5G is not the frequency or the power levels but the proximity to people. This recommendation talks about a setback which is dealing with the unique quality of 5G. It's very close to people. There are some other applications and implementations like smart meters that might also fall into this. We need to come up with a definition of what sort of transmissions we are talking about because to call it 5G is to give it a trade name rather than a physical definition.

RECOMMENDATION 8- Require power intensity disclosures for renters and buyers and for public buildings (locations where the general public may go)

Wells: This recommendation requires power density disclosure for renters and buyers and also public buildings. The idea here is that some agency of the state would also be a recipient of those readings so the public has some idea of what they are exposed to. I understand that the objection has been made many times that there is no safe threshold that has been specified. But we know that just as kitchen appliances have an energy usage scale on them showing where they fall on the range of low energy and high energy use, the same sort of scale could be understood by buyers and renters that perhaps less intense energy is more desirable than more intense energy. They can figure out where they stand in that continuum.

One other part that is important on this, in order to make this practical, the instruments used need to be affordable and available. We have identified one particular example, the GQ 390 meter and the price is under \$200. Some agency of the state could loan them or real estate agents may find it's more convenient to own their own.

On the state owned ones, it would be easy to get the manufacturer to verify they are all benchmarked and consistent in their sensitivity.

Abrami: the more thought I give to this one, there are really two pieces to this, the buyers and the sellers and then any public place. I think any public place would be really unwieldy. But the buyers and sellers, it's akin to getting a water test and a radon test. That's, basically what we are talking about.

Sherman: I have a concern. I see this running smack into the realtors. You and I have worked with them in the past and I am just thinking of a pre-recommendation compromise and one thought would be rather than requiring of a measurement and Michelle would probably tell us would require funding to have this program. In other cases, haven't we required full disclosure if you have knowledge of issues on the property. The seller would be required to disclose radon levels, lead paint, all of these other things. Couldn't we say the owner would need to disclose potential RF exposure or known RF when you sell a property?

Rather than putting in a whole new infrastructure, I think this is going to run into pushback at the fiscal level and at the regulatory level. But a lesser would be to require any known exposure to RF or RF levels.

Gray: This one is so broad reaching. What happens when I change one of my routers? Do I have to go retake the measurement and redo the posting? Again, we don't know what the safe level is. One of the things that could be done if we did know what the safe level is would be to set a limit up to this. And I know Dr. Chamberlin says it's the way we do beam forming and all that. This would be very difficult to do.

Abrami: the real estate folks have already weighed in by the way. You can imagine which direction they weighed in on.

Roberge: I was going to add in. Senator Sherman touched upon it. Depending upon how you envision this being implemented, there could be costs associated if this gets delegated to an agency to implement.

Chamberlin: we would definitely have to specify the conditions under which the measurements would be taken. I would say that when you are going to take these measurements for real estate purposes, you would turn off all internal sources so everyone would be on the same level playing field.

Abrami: Ken, you mentioned the Bio-initiative 2012 report, the 1,000 microwatts per meter squared.

Wells: There is a recommended maximum level by the Bio-initiative 2012 report of 1,000 microwatts per meter squared. This is a pretty high level. This is a peak exposure. These meters could measure peak and averages over 24 hours and could measure frequency. There is quite a bit of information that would be available and I think it would be valuable for the agency that collects this. It would allow them the basis for building a map of RF around NH and give them data for pursuing future public health investigations about say cancer clusters in relation to transmission or cancer clusters that are not related to transmission but perhaps some other environmental sources.

Abrami: This, ties back to Kent's proposal about a database but this would be real data. There could be hotspots in a neighborhood or a town. All we are saying is, maybe before you buy a house, you want to know about it. We went through this with radon and lead paint. The more we see radiation flying every

which way, I think this is prudent. It doesn't have anything to do with the industry or the federal government. It's just informing the buyer or the renter that you might be in a pretty hot zone.

Heroux: Actually, Senator Gray is right. If you install another antenna, the levels will change. Essentially, this is what you are trying to determine by a number of these measurements to see what the evolution in a particular place or state how radiation is evolving. These measurements are fundamentally fairly easy to perform if they are performed by an instrument. They are probably preformatted so compiling them could be relatively simple.

Woods: Going back to the fact that we could sort of massage this. The concept is very good and this is a recommendation that says to the public besides the legislators in this report that this is an area that we need to consider. Now, the details are going to be a morass to say the least. But I think as you pointed out earlier Pat, these are areas that we see as a commission that need attention. As Tom said, the realtors are going to have some input but I think that's for another day. To the Legislature and to the public, we are saying we feel this is an important issue.

Ricciardi: I just wanted to say that maybe an RF map would be good for people who are already microwave sick. That way they would know where the transmitters are the highest and could avoid them.

Wells: I think that's a great idea. I just wanted to point out that Cece Doucette put something in the chat that there is already an RF meter loan program in Ashland, MA through the public library. This would not be hard to do. They are not terribly expensive.

Gray: It appears what you really ought to do after listening to Dr. Chamberlin, is split it into two. If you are transferring real estate then taking measurements with wifi turned off etc. may be appropriate.

But if we are talking about posting for the public, then it's radiation when I walk into that building which would include all the sources inside the building. It is unclear what you are really trying to do with this. Are you trying to mix these two concepts together? You've got to remember that exposure for most people would be a long term thing that would affect them and not a short term thing.

Abrami: I agree. I think I said this earlier. Comingling the purchase of property vs posting measurements in public areas in the same recommendation is a tough one. If anything, we could split them out and vote separately.

Wells: How about if I take the public building part of it and make that a separate part or possibility for future consideration?

Abrami: that would probably be better.

RECOMMENDATION 9- Require all new cell phones sold in New Hampshire come equipped with a sensor that will stop the phone from radiating when positioned against the body.

Heroux: This speaks to the fact that there is an opportunity in cell phones themselves, to mute the radio emissions when the phone is held against the body. There are various ways of implementing this. Initially, I presented it as the fact that the phone should be hardwired to do this. There are many other ways to do this. The weakest way is to say we require that you can download an application that will make your phone behave that way. The most sensible one might be to have a toggle on the phone or a menu item that allows the phone to function in this manner. If you choose not to have your brain radiated, you can choose that function on the phone itself. Between these extremes of you having it hardwired or you having to do a lot of things to eliminate the radiation. Or there is another possibility the phone could come with the toggle switch installed and you could disable it if you wish. That means you choose and you agree that you believe that this risk is not substantial so you prefer to use the phone against your head rather than avoid the risk.

Abrami: I think it has to be individual preference. We want to give those who are concerned about it a chance to have something that will help them.

Wells: this is the first that I have heard of that last suggestion and I think that is a good one that the phone is delivered to the customer with the safety option on and the user has the option of disabling the safety function.

Sherman: One other option in this would be I believe this is true that they have this capacity but have opted not to install it on phones, the idea of intrinsic shielding that would protect the customer from radiation. There was a move about fifteen years ago to develop sleeves that you could put over your phone to shield against the RF that was emitted toward your head. I like the toggle idea. I would not go for the requirement that all phones shut down if you put them by your head. The toggle and personal choice is a great option. Or the other part you could put in there would be the intrinsic shielding.

Gray: Are we creating a scenario where phones are not going to be sold in NH anymore?

Abrami: this is simply a recommendation to the cell phone manufacturers to consider.

Gray: We are not as big as the state of California who has driven emission regulations by state regulation. I don't know that the cell phone industry is going to modify what is available to customers because of the state of New Hampshire.

Abrami: the cellphone industry knows that holding the phone against your head may not be the best thing because it's in their legal section. There must be a reason why they are saying that. So, if you believe that then why don't you install an option where a user could turn it off. That's all we are doing as a commission is recognizing this issue and making a recommendation. It's got to start somewhere. It's my understanding that other states are following us on these proceedings. If we take that first step, other states may also weigh in on it.

Ricciardi: I just want to add to that is that our job is to protect the residents of New Hampshire. That's what we are doing with these recommendations. Again, they are recommendations, not law. We have to do that. With all due respect to everyone, here all opinions are appreciated but as we know, the majority will write one report and those who are in disagreement are entitled to write their own. I would caution on making too many changes to the one we did if the majority agrees with it. Since the other report will be written anyway. Thank you.

Gray: The point that I was trying to make in a lot of this thing is that if we go right back to the first paragraph and we say these things aren't proven. So to make recommendations that may impact the cell phone may cost more in NH. There are reasons why we should be cautious in the recommendations that we make.

Heroux : I take Senator Gray's point that New Hampshire is not as large as California and in some instances may not have the same influence. But I have to say, I am a fan of New Hampshire and maybe you are as big as you feel.

Wells: I just want to remind everyone about New Hampshire's role in MTBE. We are not without influence.

Abrami: Let's do number ten. Eleven is still under consideration and twelve we can talk about next time.

RECOMMENDATION 10- Propose legislation that would facilitate the implementation of fiber optic cable connectivity deployment and internal wired connections to serve all commercial and residential properties statewide.

Abrami: it's just basically a statement that the state should promote fiber optic cable. Carol had to leave. I am going to let her weigh on this next time. Members of the work group, I want to work on their recommendations based on this input. Jim has some good comments in his as well as the others and should take those into consideration. We are running out of time. Unfortunately, we lost almost four months. I couldn't even get zoom time from the House. Good thing Kent has been gracious enough to let us use the University of New Hampshire's zoom account.

I think we need to have more than a meeting a month.

Sherman: We are having trouble on the Senate side with all the zoom meetings we need to have. So if we could have all the materials we need for the next meeting well in advance and preferably have a longer meeting rather than three shorter meetings and just get the work finished as best as we can.

Abrami: I'd like to do it in three weeks. How about Tues the 22nd at 9? We will make it a 2.5 hour meeting. Kent will set that up. Thank you everybody. We will make our way through this.

V. Next meeting via Zoom: Sept 22nd 9-11:30

Meeting Adjourned at 11: 15 am

Text chat during Zoom meeting:

00:51:58 Paul Heroux, PhD: Identify Health Impacts of Environmental Factors: Barack Obama and Joe Biden believe it is critical to understand the relationship between environmental factors and risk or onset of disease, particularly cancer.

They support the efforts of Senators Clinton and Hatch to expand CDC biomonitoring programs, and as president, Obama will expand the collaboration between the CDC and state public health agencies across the country to increase understanding and improve treatment of individuals negatively affected by environmental factors.

01:19:35 Cece Doucette: For Recommendation 2: Might NH consider taking a leadership role with peers in all other states, share the Commission's final report, and encourage them to make a similar request to their federal delegations? This approach might help to get meaningful action to protect the public sooner rather than later since the 4G/5G small cells are going up in real time, and children are being given wireless devices to access their education with no safety instructions.

01:29:43 Cece Doucette: Thank you, Dr. Sherman. It would be helpful to the public to label every RF-emitting device, including utility smart meters and the collection devices mounted on poles outside of residents' homes.

01:36:19 Cece Doucette: For Recommendation 5: Please vet all new technology through non-industry funded scientific investigation before exposing our collective children. LEDs and Li-Fi may have risks, but hard-wired technology to the premises with Ethernet cables and adapters is proven safe.

01:43:13 Cece Doucette: For Recommendation 6: Please see Burlington, MA Small Cell Policy, which requires an annual recertification by an independent expert, and the wireless vendor pays the town to complete the annual recertification.
http://www.burlington.org/town_government/small_cell_information.php

01:48:36 carol.a.miller: I apologize but I have a hard stop at 11am this morning. I will just disconnect when that happens.

01:48:53 Beth Cooley: Same here

01:56:29 Cece Doucette: For Recommendation 8: We have modeled an RF meter lending program at Ashland Public Library, MA. Others are emulating this too. It was based on kill-o-watt meters put on loan in our libraries by the energy industry.

02:04:35 carol.a.miller: Again I apologize that I must leave the meeting now.

02:06:10 Cece Doucette: Thank you, Ken.

02:09:00 Brandon.H.Garod: I apologize but I have to leave for another meeting.

02:09:26 Cece Doucette: Please consider adding a new recommendation to educate the public. I drafted a fact sheet with the MA Department of Public Health, and have built a non-profit with quick on-line courses that the public could take today and have the right to choose how they wish to use the devices within their control. Please see <https://www.wirelesseducation.org/store/l2/> and <https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbX1bmRlcnN0YW5kaW5nZW1mc3xneDo2OWYxMmNhY2ViNDcwMmQx>

02:15:05 Cece Doucette: For Recommendation 9: Shielding can be helpful, but unless the shield absorbs the radiation, it will deflect it back into the hand, other body parts, and other people/children in the vicinity. We have seen hand cancers from cell phones too. See attorney Jimmy Gonzalez testimony in Florida: <https://www.youtube.com/watch?v=XitM4lkpvgo>

02:17:31 Marty Feffer: Unfortunately, only humans will be able to make the choice to limit their exposure to cell phone radiation with the ideas you are discussing. The natural world who are also being irradiated, and have been, are suffering just as much, if not more, from exposure. Our responsibilities run deep and wide if we honestly look at the complete picture.

02:21:09 denise ricciardi: to sign off

02:22:51 Paul Bloede: My apologies for asking if I was being spoken to, earlier; I hadn't studied my notes from last time, closely enough, apparently, to realize there is a Paul who is truly a member of the commission: Dr. Paul Heroux. Again, my apologies.

02:23:51 Marty Feffer: Thank you for your work. Inspiring to other states.

**NH COMMISSION TO STUDY THE ENVIRONMENTAL AND HEALTH EFFECTS
OF EVOLVING 5G TECHNOLOGY**

Meeting held:

9/22/20

9:00-11:30 am EST

Via Zoom (<https://unh.zoom.us/j/95115866784>)

Via telephone-US (1 301 715 8592 (US Toll) ID: 951 1586 6784)

In attendance: (13)

Rep. Patrick Abrami-speaker of the house appointee

Rep. Ken Wells- speaker of the house appointee

Kent Chamberlin-UNH-appointed by the chancellor

Denise Ricciardi-public-appointed by the governor

Michele Roberge-DHHS- Commissioner of DHHS appointee

Dr. Paul Heroux- Professor of Toxicology, McGill University- speaker of the house appointee

Rep. Gary Woods-speaker of the house appointee

Senator Jim Gray-president of the senate appointee

Senator Tom Sherman-president of the senate appointee

Brandon Garod-AG designee, Asst. AG Consumer Protection

Bethanne Cooley-CTIA , trade association for wireless industry and manufacturers

Carol Miller-NH Business & Economic Affairs Dept * *(joined meeting in progress)*

David Juvet-Business and Industry Association

Not present: (0)

Meeting called to order by Rep Abrami at 9:03 am

Abrami: Due to the Covid 19 virus and the Executive order signed by the Governor this public meeting is allowed to be conducted via Zoom. It is open to the public for viewing and was duly posted as a Zoom meeting. With that said, if you are not a member of the Commission, can you please turn your cameras off and mute yourselves? That would be much appreciated. In addition the meeting is being recorded as an aid to doing the minutes. All chat room discussions will be included in the minutes.

Since we are going to be taking some votes today, I am going to have to do a roll call. That is also a requirement. The votes today will be in the order going to my left as we were seated in Concord for our meetings. Please say where you are and if anyone else is in the room.

Tom Sherman- I am here alone, Rye NH

Ken Wells- I am in East Andover with my dog.

Kent Chamberlin- I am in Durham, NH and I am alone.

Carol Miller- absent for roll call. *(Joined meeting while in progress later)*

Denise Ricciardi- I am in Bedford and I am alone.

David Juvet- I am at the BIA office in Concord. Others in the building but I am alone in my office.

Beth Cooley- I am in Sarasota,FL and I am alone with the exception of my dog.

Brandon Garod- I am at the AG's office, Concord. Others are in the building but I am alone in my office.

Michelle Roberge- I am alone in my office at DHHS, Hazen Dr. Concord.

Paul Heroux- I am in Montreal and am home alone in my office.

Gary Woods- I am in Bow, NH and am in my study at home alone.

Jim Gray- I am alone here in Rochester alone in the kitchen having breakfast.

Pat Abrami- The Chair is here in Stratham, NH and I am home alone.

Ok. Thank you. So we have 12/13 present at the moment.

I. Approval of minutes from 8-31-20:

I have not received any changes to the minutes. Are there any changes that anyone wants to make? Seeing none, I will say ...without objection, we approve the minutes from that meeting.

II: What remains for the Commission:

Abrami: I spoke to the Speaker this week to see if there was any wiggle room with the November 1st date. He said it would be very difficult to change. So, my intuition is we strive to get to the November 1st date to get the report done. Just keep that in the back of your mind. We have had a work group of seven working on recommendations and we are going to vote up and down on those.

There will be a Minority Report. My goal is to give those involved with the Minority Report proper time to react to the Majority Report in their report. My goal is to have the total report done by the middle of October, if we can. We have a lot of pieces of it. Joel Anderson, staff member appointed to the Commission will be helping put those pieces together.

So, that's where we are at. My goal is to have one or two more meetings. The Majority work group will have to meet to put finishing touches on the report and get it to Jim and whoever wants to work with Jim on the Minority report to give them a week or two. I am thinking the full Commission needs to meet the third week in October just in case we need another week to do some adjusting.

III: Minority Report and Agency Disclaimer:

I sent out to everybody some sample reports of Minority reports. In this case, I think what we will do is make the Minority report part of the report and it will be the last section where the Minority can say what it's going to say. It will have a header that it's the Minority report. So it will be one report that will include both.

As far as the agency disclaimer, Joel dug out my old marijuana Commission report. At the end, the agencies had trouble saying they agree or disagree. Brandon, Carol and Michelle are the three that work for the state. This is what I think it's going to sound like: Members of the Commission of the study of the environmental and health effects of evolving 5G technology agree to the filing of the report by the chairman. This action should not be construed in any way as an adoption of any particular position of a commission member or the state agency or organization they represent on the underlying issue of the deployment of 5G technology. It's as simple as that. I think this may make the members who feel

uncomfortable more comfortable with their position on the report. Brandon and Michelle, any reaction to what I just read?

Garod: I think at first glance, that language probably will work for DOJ but I would like the opportunity to run it by the Attorney General to make sure that he is comfortable with it.

Roberge: I agree, same thing. I would like to run it by our folks here.

Abrami: I will retype it and send it so you have a hard copy to share with them.

I am going to move this along. We had a meeting and talked about most of these recommendations and a few new ones did come up. It would take a lot to change a recommendation. If someone says, if you change it this way or that way and I can vote for it, understand that the work group pretty much agreed to the language here. Obviously, grammatical things will be accepted and if you have a real issue with a particular recommendation, my sense is you would probably be in the minority report. I apologize in advance, but I am going to move this fast. I just want to make sure we get this all in today so we can move on to finalizing the report.

IV. Work Group Recommendations and Vote:

The rule is, we need to have a roll call vote on each of these per Joel and the folks that know about these things. We are going to talk quickly about each of these and take a vote. When you vote, you will vote ... yes, no or abstain. The majority of those who vote yes or no will make it into the majority report. That's what the ground rule is. Is there any objection to that ground rule? I don't see any. Thank you.

If you read the intro to it, what the work group concluded is that (in my words) the science is conflicting in some regards but there is enough science out there that's showing more study needs to be done on this topic. Given that we tried to reach out to federal agencies and they didn't really answer our questions and all the other things I mention in this intro, the conclusion of the majority is that we have to use the Precautionary Principle here. You will find that we have softened some of the recommendations from the last meeting. I am assuming that there may be enough that these are the majority position but it may not be. It may be the minority. I kept the numbering the way it was so we didn't confuse anyone even though we will be taking #2 off the table. After we are done voting, we will reorder these for the report in a logical way.

Juvet: Mr. Chair, could I ask a process question before we start on each of the recommendations?

Abrami: Absolutely, Dave.

Juvet: As a part of voting, are you looking for just an up or down vote? Or can we, as members of the commission explain why we are voting the way we are for the permanent record? I don't want to make this process any longer than it needs to be. I just need some clarification.

Abrami: You can do that during the discussion.

Sherman: I know we are going on the recommendations, but before we do, in the version I have which says 5G commission recommendations at the top of it. I think it's the Sept 17th version. Is that the latest?

Abrami: yes.

Sherman: There is a sentence that to me does not make sense. Would this be an appropriate time for me to point that out?

Abrami: Yes. Please.

Sherman: It's in the introduction, midway through. You will see the words, "the effect of the soup". Then it says, "today, which will only be growing in the world of if the roll out continues is not known" That phrase grammatically does not make sense to me. I don't know what the intent of that phrase was.

Abrami: if anything, the amount of RF will be expanding over time.

Gray: I took it as "the soup" is going to be growing, the amount of RF. That's what I took from it.

Sherman: But if I could just wordsmith that just to keep it simple.

Abrami: Yes. Absolutely.

Sherman: The effect of the soup of RF waves surrounding us today, which is likely to increase over time. Perhaps, you could do something like that, because it was unclear.

Cooley: We will be providing comments to Senator Gray's Minority Report (CTIA). Second, I would just like to publicly object to the entire introduction, most notably the first sentence. The Commission has indeed not heard from many experts on both sides of the issue. As you recall, the Commission heard from one pro-5G Physicist on November 20, 2019 who ran out of time. I do understand that the pandemic did lose us many months. However, upon learning of new research during the summer regarding the safety of 5G, I offered to reach out to the authors of that study and I was told in no uncertain terms that there were to be no more experts. However, funny enough, I then hear of a so called expert presenting before the working group at their Sept 11th meeting. We would just like as an industry and CTIA to highlight that this biased approach and preordained outcome of the Commission has not gone unnoticed, and we will be making these facts very clear to the General Court. Thank you, Mr. Chair for the opportunity to speak.

Abrami: right and how many times did I say to you even before the virus, give me your best shot and any time you want another speaker, let me know. It isn't like I didn't do that. We lost about four months with the virus. The group argued that we really didn't have much time to hear additional testimony. Yes, Paul suggested we hear from this lawyer, who wasn't a technical guy to possibly help us with some of the language.

Ricciardi: I just want to address something since Beth has brought up the word "biased". I think you represent the CTIA and having been in a lawsuit in Berkley, not wanting to have the fact that the information about the proximity of the phone to the body that is hidden inside the information for the

phone, not brought out, which was the lawsuit. That could be considered biased too, seeing that you are on the Commission. Thank you.

Abrami: I understand. I had many emails about this, Beth. I batted them away. There were people out there who wanted you off the Commission and I said absolutely not.

Cooley: Yes. I heard both the allegations and personal attacks against myself, CTIA and the industry. Again, the facts will be made clear to the general court.

Abrami: That's fine.

Gray: This is Senator Gray. We need not to be defensive about comments that are made today and try to rebut them. We just need to accept them as a comment and move on or we are not going to finish anywhere near eleven.

Abrami: I agree, Senator. Again, that's what the Minority Report is for.

RECOMMENDATION 1- Propose a resolution of the House to the US Congress and Executive Branch to require the Federal Communication Commission (FCC) to commission a review of the current radiofrequency (RF) standards of the electromagnetic radiation in the 300MHz to 300GHz microwave spectrum as well as a health study to assess and recommend mitigation for the health risks associated with the use of cellular communications and data transmittal.

The Telecommunications Act (TTA) of 1996 was adopted before the health risks and biological effects of RF-radiation to the human body were fully known to the scientific community as well as the public. The Commission believes that the FCC has not exercised due diligence in its mission to manage the electromagnetic environment, failing to support technical means and investigations aimed at reducing human exposures to electromagnetic radiation (EMR) in telecommunications systems, and optimize wireless modulations to reduce biological and health impacts. Commissioned research should study the health effects and should be conducted by an independent research organization with standards which have been mutually agreed to by all the stakeholders. The FCC shall then ensure that the findings and recommendations are adequately disseminated to the public.

Abrami: First we had #1 as a joint resolution and I agree with Senator Gray, that the Senate does not like joint resolutions and they would never do one. So, we put a resolution of the House. Basically, what #1 says is more health studies are needed. We broadened the range to include anything in that range, not just 5G. Discussion?

Chamberlin: This is just wordsmithing. The section that says, "investigations aimed at reducing human exposures to EMR". Well, we are not really trying to reduce radiation, necessarily. The wording that I suggest is: "we want to set exposure limits that protect against negative health impacts". I would suggest making that change.

Sherman: I have a change as well. It reads, "require the Federal Communication Commission (FCC) to commission a review of the current radiofrequency (RF) standards". I would say, "an independent

review". It's already been determined that the bulk of the FCC is comprised of Commissioners who have spent a significant component of their career in the telecommunications business. So, for them to have an in-house review of this, is like having the fox watch the hen house. That's true of any federal agency. They would typically do an independent review.

Heroux: Is it necessary to point to the FCC? We know historically what the FCC does and they just performed a review that they will just repeat. So, why not say the federal government?

Ricciardi: I agree with Paul. Also, the industry says that the biological effects are not health effects. We know that it is so I think the wording has to be in there that you have to have clarification about the impacts of biological effects.

Abrami: It's interesting that most of these changes are coming from the work group. So we are saying the federal government.

Ricciardi: and add protect against the biological adverse effects.

Heroux: Yes. This is what I was suggesting.

Sherman: She is referring to the non bolded section. I would leave it because it's more inclusive the way it is. It's in there twice already.

Sherman: Mine was independent review and Paul's was federal government. I kind of like leaving the FCC.

Abrami: I didn't have a problem with the FCC either.

Woods: I would leave it as the FCC and I think the important part would be to have fabricated that it's independent.

Sherman: Why don't we go ahead and vote on this one?

Abrami: So, keeping the FCC, adding independent review and changing to exposure limits to protect against health impacts, any other discussion?

Juvet: Mr. Chair, before you call the roll I just want to let the Commission members know that I am going to be voting against this recommendation. It states in the non bolded area that the commission believes that the FCC has not exercised due diligence in its mission and my organization just doesn't believe that is true. So, I will be voting against this recommendation.

Abrami: Ok. Thank you, Dave.

Gray: What I would put into the Minority Report on this one is that we don't have a problem with further research. You could even fund the research from the federal government. The way you conduct that research though and some of the other in here is what we would object to. In principle, the research I am good with but the rest of it...no.

Abrami: Thank you Jim.

Heroux: Just to be clear, I would vote for this recommendation whether it's FCC or federal government. It's just with the federal government somebody would have to make the decision to ask the FCC, which will be a further decision. But, both carry the same idea.

Abrami: Ok. Thanks, Paul. Ok. Here we go. I will call the roll: Tom Sherman (yes), Ken Wells (yes), Kent Chamberlin (yes), Carol Miller (absent), Denise Ricciardi (yes), Dave Juvet (no), Beth Cooley (abstain), Brandon Garod (abstain), Michelle Roberge (abstain), Paul Heroux (yes), Gary Woods (yes), James Gray (no), Patrick Abami-Chair (yes). There are 7 (yes); 2(no); 3 (abstain) and 1 absent. The motion passes.

RECOMMENDATION 2- Establish a State position that protects the State and all its Municipalities from any liability from harm caused by small cell antennae placed on the public rights-of-way. Specifically, liability of the State of New Hampshire and its municipalities connected to harm caused by claims of personal damage or harm from the deployment of 5G small cell towers or the attachment of 5G antennae on telephone poles, electric poles, lamp poles, or other structures on the public right-of-way is by state statute transferred to the Federal Government. The Federal Government shall be required to defend and indemnify the municipality from any liabilities arising from permits and the installation, operation, and maintenance of small cell installations. Since the State of New Hampshire and its municipalities are being forced by Federal Law to deploy 5G small cell towers and antennae on public rights-of-way, the Commission has concluded that that the State and its municipalities should be held harmless from any litigation claiming harm for any reason, including damage to health. The Committee feels that this recommendation should not be of any burden to the Federal Government or to the cellular industry and related industries who support the cellular industry, since they believe that 5G technology is safe and thus there will be no harm caused by having these antennae so closely deployed to the public on the public right-of-way. **DEMOTED TO SOMETHING THE COMMISSION DISCUSSED**

Abrami: The workgroup has decided to take this off the table. We kept it here for numbering purposes. It will be demoted to a topic of discussion in the report saying the commission discussed this issue. The position of the workgroup was to not include this recommendation. So are we ok just skipping this? If you want to say something, raise your hand or just speak out. It's quicker. There is no one monitoring this other than myself. Ok.

RECOMMENDATION 3- Require that the most appropriate agency (agencies) of the State of New Hampshire include links on its (there) website(s) that contain information and warnings about RF-Radiation from all sources, but specifically from 5G small cells deployed on public rights-of-way as well as showing the proper use of cell phones to minimize exposure to RF-Radiation. In addition, public service announcements on radio, television print media, and internet should periodically appear, warning of the health risks associated with radiation exposure. Of significant importance are warnings concerning the newborn and young as well as pregnant women. Even without further study, there is compelling evidence that the public should be warned of the potential dangers of RF-radiation and be told simple steps to lessen the risks of unnecessary exposure. Attachment XX shows an example of a simple cell phone warning.

The website must provide an option for visitors to register their concerns about current FCC exposure guidelines. In particular, this registry should provide a convenient and formal mechanism for New Hampshire municipalities and residents to weigh in concerning the contentious 1996 Telecommunications Act Section 704 that disallows using radiation-related health concerns as a reason to challenge cell phone tower siting. The primary use for the data collected on this registry will be to gauge the level of concern about RF-radiation exposure there is on the part of New Hampshire citizens.

Abrami: This has to do with public information related to RF radiation in general and public service announcements and postings of certain warnings. Kent, I think you and Carol worked on this.

Chamberlin: This is part of informing people about potential problems associated with exposure to fields. Now a lot of people do not realize that there are any negative effects. This would be an opportunity to provide warnings both on the signs and on the webpage indicating what those potential hazards are. The other aspect of this is to allow people to provide an opportunity for New Hampshire citizens to register their concerns about the current legislation, for example the Telecommunications Act of 1996. It would be just a way for them to air their concerns. The data would be used to inform us or the state about what the level of concern is. As I mentioned the last time, if only a handful of people are concerned, then perhaps it's not that big of an issue. But my own experience having people call me at the University to have me come out and make measurements and ask what they can do about cell tower exposure. I haven't been able to send them any place where they got satisfaction. This would be an opportunity to provide a registry for people to log concerns about exposure to RF fields.

Abrami: Kent, I think a lot of what you are saying relates to another recommendation. This was really Carol's. This was more about public service announcements and things on the website.

Chamberlin: I am sorry. I did mention that but my apologies that does relate to another one.

Sherman: there is a typo in the second line: "their" is what it should be.

Juvet: I just have a question about the first sentence in the bold where we are suggesting that the most appropriate agency or agencies of the state include links. As a commission that's been studying this, are we unable to name which agencies we think should be responsible for this?

Abrami: Originally, we had DHHS but we decided that it could be more than one. It could be others like environmental. So, we just kept it broad.

Heroux: In the version I have, the last paragraph, it does mention that the website must provide an option for visitors, as Kent had indicated. Does this mean that this paragraph has been transferred elsewhere? It means that there are links for people and perhaps by filling out a form.

Sherman: He is saying it reads that the website must provide an option for visitors to register their concerns about current FCC exposure guidelines.

Chamberlin: The intent was not to go to the FCC but would be a registry for the state of New Hampshire.

Heroux: What Kent is saying is that there is no way for any citizen who is concerned to voice that concern and their situation and it is not wise for New Hampshire to be totally deaf to such a situation. It could be fairly simple. There might be a standard form that can be uploaded and simply kept on file until for some reason it is decided that this needs to be analyzed.

Juvet: Mr. Chair, can I make a comment on this point? Two things: If we are only allowing a vehicle to only register concerns, you will get a very one sided point of view and I am wondering if that could be changed to say register their opinions.

Abrami: I think you are correct.

Juvet: the second thing is more of a procedural thing. I am unclear if this is established, what happens then? I am not quite clear on how this information will be used.

Abrami: The data could be accumulated and then interested parties would have a place to go to look for opinions of the public.

Juvet: One final comment about midway through that paragraph, you are labelling the 1996 Telecommunications Act as “contentious”. I think that is a little pejorative also and I would remove the word “contentious”.

Sherman: I would go one step further and take out that middle sentence because it is judgmental.

Abrami: you are suggesting that we take out the section that says: this registry should provide a convenient and formal mechanism for the New Hampshire municipalities and residents to weigh in concerning the contentious 1996 Telecommunication s Act.

Sherman: I would get rid of the word “contentious” no matter what. I agree with Dave. I would change it as a way of people logging opinions rather than telling people what they should be discussing.

Abrami: Most of the public has no idea what the 1996 Telecommunications Act is. Municipalities would because they are doing these sitings all the time.

Sherman: I would just get rid of” contentiou”.

Gray: The first objection I have is the word “compelling” in the first non-bold sentence. If we look back to the preamble, we say the science isn’t all in and throughout this report I don’t believe we should set up a new division in the state anywhere that summarizes all this stuff and has action etc. But, we will put all that into the Minority Report.

Sherman: I agree with Jim. We are saying we are going with the Precautionary Principle because we don’t know. So, saying “compelling” says we know. There is evidence that the public should be warned. There is evidence but there is some editorial comment in this report that is stronger than what I am comfortable with. Get rid of the word “compelling” and “contentious”. I think it sounds a little less judgmental and a little more acceptable to your audience.

Juvet: Mr. Chairman, along those lines, in the very last sentence of the non bolded section says “the primary use of this data collected on this registry will be to gauge the level of concern. I would be more comfortable with “opinion” in place of “concern”.

Abrami: I am ok with that as well. Are there any other changes?

Roberge: I request some qualifying language around “appropriate funding” if this was to go to a state agency and the agency was required to do PSAs or whatever. There might be a funding issue that may come up.

Sherman: Michelle, you make me smile.

Abrami: ... this cannot occur unless the legislature provides proper funding. Is that ok?

Sherman: you could say that the legislature fund the most appropriate agency in the state of New Hampshire. The first step as Michelle is saying and those of us in the legislature know the first step is you need the funding. You could put “supported by funding granted by the legislature”.

Gray: When this goes to the legislature for adoption, it will get reviewed and if there is funding required, it will be part of it. So, I don’t even think you need to talk to the funding specifically. Thank you.

Wells: Back on the last item where we talked about the level of “opinion”. I think it would be more appropriate to say level of “interest” about RF radiation exposure on the part of the public.

Juvet: I don’t have a problem with that. I agree.

Abrami: I think I got all the correct changes. We have the funding piece. We have the correction on the “there” to “their”. We got rid of “compelling”. We got rid of “contentious”. We replaced “concerns” with “interest”.

Juvet: Mr. Chair I am going to be voting against this recommendation and the reason why is related to the budget and potential fiscal issues. I am not ready to commit the BIA to supporting that before we have a chance to review the context of the entire budget.

Abrami: Remember, with any of these recommendations, it would take someone to put some of these in bill form to propose to the legislature and make it through a difficult legislative process.

Juvet: I appreciate that but if I vote for this, it could be construed that the BIA is in favor of that as a part of the overall budget. I’m not there yet.

Sherman: Could I just ask Dave a question? You do have the option of abstaining. If you are voting against it, my interpretation is that you are opposed to this moving forward as a recommendation....that the recommendation is something that the BIA could not agree to.

Juvet: Thank you, Senator. I agree with you. So, I will be planning to abstain on this one.

Cooley: I will be opposing this because of the implied risk of wireless radiation.

Abrami: Any other discussion? I will make a motion that we accept this.

Sherman: I will second.

Abrami: I will call the roll: Tom Sherman (yes), Ken Wells (yes), Kent Chamberlin (yes), Carol Miller (absent), Denise Ricciardi (yes), Dave Juvet (abstain), Beth Cooley (no), Brandon Garod (abstain), Michelle Roberge (abstain), Paul Heroux (yes), Gary Woods (yes), James Gray (no), Patrick Abami-Chair (yes). There are 7 (yes); 2(no); 3 (abstain) and 1 absent. The motion passes.

RECOMMENDATION 4- Require every pole or other structure in the public rights-of-way that holds a 5G antenna be labeled indicating RF-Radiation being emitted above. This label should be at eye level and legible from nine feet away. In the view of the Commission, the State of New Hampshire has the right to warn the public of potential harm of 5G antennae deployed in the public rights-of-way. Large cell towers all currently have fencing around them at their base to protect the public. This will not be the case with small cell towers or any pole with an antenna on top in the public-right-of-way. These public rights-of-way are the jurisdiction of our municipalities and not of the Federal Government. The Telecommunication Act of 1996 did not contemplate antennae being placed on the public rights-of way of municipalities. Thus, the State of New Hampshire has the right to warn the public harm by requiring the owners of these antennae to inform the public of potential from RF-radiation harm. See Appendix XX for an example symbol.

Abrami: We talked about this last time. The game changing with 5G, not all cell companies are rolling out small cells in the right of way but some may be. For many, that's a game changer. All this is saying is that if that is the case, there should be some sort of labelling that there is an antenna on top emitting RF radiation. Beth, I know you had some concerns about this as there is RF related to power lines and all that. The subgroup decided to keep this recommendation.

Juvet: Mr. Chair, I'm going to be voting against this recommendation. I think it sends a conflicting message. I think it potentially makes NH different than every other state in terms of 5G rollout. I think if this is an issue then it's something that should happen at the federal level as part of federal legislation so the requirement is the same for all states. I can't support this recommendation.

Ricciardi: I just have a question. Is there any rule for participation in these groups? When someone misses a lot of the meetings, I don't think they have all the information they need to make an informed decision. It's just a question, Mr. Chair.

Abrami: Let's go way back. Dave and I chatted early on and certain days of meetings Dave could not attend because of a conflict with his board meetings with the BIA. Plus we were into the science and I know Dave was pretty eye rolling. So after the virus hit and we finally came back, I just assumed that Dave didn't really want to participate. That was a false assumption on my part. Dave reached out to me and said he is officially appointed to this commission. I cannot take him off this commission. None of us can other than the person who appointed him. So, he is still a formal member of this commission and yet he missed a lot of the meetings. The minutes are out there on our site. I don't want to make a big deal about this.

Sherman: Denise, I just want to point out the minutes and presentations are on the site. If you miss commission hearings, you do have the ability to catch up. And I am assuming that anyone who is participating in voting is up to date. That's what we do in commissions as we have that capacity. I am on more than 20 commissions and committees right now. There is no way I can make every single hearing. I agree with the Chair. We should move on and assume that Dave has done his due diligence and has every right to vote as an appointed member.

Ricciardi: It was just a question. I wanted clarification. Thank you Senator.

Abrami: Just for the record, our minutes are basically almost verbatim of what's being said. They are very extensive minutes. I move to call recommendation four for a vote. Tom?

Sherman: on the discussion side, I just have to say I have a concern about this one. First of all the labelling, I agree with the industry that there are many sources of RF and I think the public should be warned but I'm not completely comfortable with this one. I am going to hold off on seconding it and give myself a few more minutes to think about it before we vote.

Woods: I will second it.

Gray: my problem with this one is we have regulations and if the emissions from the cell tower meets the current and if we are saying that the future ones of our recommendation number one if it exceeds those then a warning label might be appropriate but again, we haven't done the research from number one. It meets current regulations and therefore the added expense of putting that sign on there and if there is still anybody who climbs poles without a hydraulic lift then that sign could be hazardous to them climbing that pole. For those reasons, I will not be supporting it.

Sherman: Patrick, the more I think about this one, the legibility of the sign, I have to agree. Right now under current law, we have already said there needs to be more study. I really am uncomfortable with this one. I think I am going to have to vote against it.

Wells: We have had quite a bit of discussion on this because the current standards don't talk about energy density in watts per square meter. When you have antenna in the public right of way, there are orders of magnitude closer to people than existing antennas. So, the RF exposure is very high.

Heroux: The other thing is that if you require it to have a full survey of all RF sources other than 5G, I realize that this may seem discriminatory. Essentially, it's because there is densification that this has provided and it would be a substantial task to inventory all sources of radiation and make sure that all of them are labelled. But at the threshold of densification, I feel this is justified.

Abrami: any other discussion? Alright. I am going to call the roll: Tom Sherman (no), Ken Wells (yes), Kent Chamberlin (yes), Carol Miller (absent), Denise Ricciardi (yes), Dave Juvet (no), Beth Cooley (no), Brandon Garod (abstain), Michelle Roberge (abstain), Paul Heroux (yes), Gary Woods (yes), James Gray (no), Patrick Abami-Chair (yes). There are 6 (yes); 4 (no); 2 (abstain) and 1 absent. The motion passes.

Abrami: Carol, were you here when I called for the vote?

Miller: I am abstaining anyway.

Cooley: I'm sorry, a clarification on that last vote. So was it 6 (yes) 4(no) and 2(abstain) because Carol was not here before the roll was called?

Abrami: yes.

Cooley: so was it 6-6 and does not pass?

Abrami: no. It's the majority of those who did not abstain.

Cooley: got it.

RECOMMENDATION 5- Schools and public libraries should migrate from RF wireless connections for computers, laptops, pads, and other devices, to hard wired or optical connections within a five-year period starting when funding becomes available. There is strong evidence that the younger the child the more susceptible they are to the negative impacts of RF-Radiation. Hard-wired connections or optical wireless do not subject children to RF radiation. The Commission is aware that school districts and public libraries have invested much in wireless infra-structure and that a movement to radiation-less connections would require additional investment of resources.

New optical networking solutions for the classroom and office spaces (such as LiFi) offer faster, healthier, and more secure connections than RF-based WiFi. This technology utilizes visible light, which organisms can withstand without any harm at far higher intensity levels (such as direct sunlight) than required for transmission. Such optical data transmission using visible light offers giga-byte speed, as well as plug-and-play replacement of current RF WiFi routers. The optical wireless system can be incorporated in an upgrade to cost-efficient LED room lighting, which can save schools and public libraries significant energy dollars.

The hard-wiring and/or optical projects should be completed within five years from when the federal funding (via say through the FCC's E-Rate program for telecommunications and IT in schools and public libraries) is procured.

Abrami: so this one is encouraging the use of hardwire or optical connections within schools and public libraries. I will let Ken spend a minute on it.

Wells: Schools and public libraries should migrate from RF wireless connections to either hardwired or optical wireless connections within five years of when funding becomes available.

Abrami: Can you spend a second on LiFi?

Wells: yes. There has been adequate research that younger children are susceptible to RF radiation and the alternative to using RF sources would be faster optical systems like LiFi or hardwired connections which don't emit radiation. Lifi is a visible light. There is adequate evidence that living things are quite

resistant to visible lights. The speed and security of optical is better than RF based communications. This would be a step up in performance and security.

Abrami: The recommendation is also sensitive to the school districts have spent a lot of money already on WiFi. Understanding that these things have cycles and there is obsolescence. We are suggesting that when funding is available that this be looked at as an alternative to WiFi.

Sherman: Can I just wordsmith one thing? In the last paragraph of the non bolded section, there are words that say: "via say through" I would replace that with: "e.g." and commas. It's a little slangy for a commission report.

Gray: Going back up to the recommendation, I am not so sure that we need to say that they should migrate. Also in the non bolded section it says "strong evidence". There are organizations out there that sell that equipment and would be more than happy to help school districts migrate over. Should they? Shouldn't they? It goes back to your first paragraph, what is an acceptable limit? If you say schools and libraries should be assisted in migrating and you take out the word "strong" and it gets closer to something that I can support.

Sherman: I like it the way it is and if Jim is not going to support it in any event then I would leave it the way it is.

Miller: I would just notate "gigabit" not "giga-byte". It's just one word, gigabit.

Abrami: Ken, are you ok with that?

Wells: Yes, that's good.

Heroux: Mr. Chair, did you ask Carol where she was and if she was alone?

Miller: I am home alone except for the dog and he is on the deck.

Abrami: I will move for recommendation five. Tom?

Sherman: I will second.

Abrami: I am going to call the roll: Tom Sherman (yes), Ken Wells (yes), Kent Chamberlin (yes), Carol Miller (abstain), Denise Ricciardi (yes), Dave Juvet (abstain), Beth Cooley (no), Brandon Garod (abstain), Michelle Roberge (abstain), Paul Heroux (yes), Gary Woods (yes), James Gray (no), Patrick Abami-Chair (yes). There are 7 (yes); 2(no); 4 (abstain). The motion passes.

RECOMMENDATION 6-Establish new protocols for performing signal strength measurements in areas around cell tower radiators to ensure compliance with regulatory radiation thresholds and to evaluate signal characteristics known to be deleterious to human health as has been documented through peer-reviewed research efforts (e.g.,[1]). Those new protocols are to take into account the impulsive nature of high-data-rate radiation that a growing body of evidence shows to have a significantly greater negative impact on human health than does continuous radiation. The measurements should be taken

in regions surrounding the tower that either are occupied or are accessible to the public. Commissioning measurements are to be performed when the site is installed and at regular intervals if required by state statute or municipal ordinance such as those required by the town of Burlington, MA [2]. Measurements should also be collected when changes are made to the tower that might affect its radiation, such as changes in software controlling it. Measurements should be performed under worst-case scenario conditions when the site is transmitting at its highest levels.

It is recognized that theoretical calculations show that existing FCC guidelines will be met by standard cell tower configurations. However, there are cases where the radiation from towers can be focused by buildings, terrain, and antennas, causing signal levels to be considerably higher than would be expected in theoretical calculations unless those effects are taken into account. Further, if measurements are performed using the protocols that are advocated, they will be sensitive to the impulses and summative effects of other radiation sources such as nearby cell towers. The measurements being advocated will require wideband equipment that is typically not used in the averaged signal measurements that are currently used. Two peer-reviewed articles that address the effects of impulsive radiation on organisms are [3] and [4].

[1] Belyaev I., Dean A., Eger H. et al. EUROPAEM EMF Guideline 2016 for the prevention, diagnosis, and treatment of EMF-related health problems and illnesses. *Rev environ Health*. 2016;31(3):363-397. Doi:10.1515/reveh-2016-0011.

[2] Burlington, MA zoning Bylaw Wireless Facilities Section 8.4.6.2 "Annual RF emissions monitoring is required for all sites by an independent RF engineer to be hired with Planning Board approval and at the applicant's expense. Test results will be submitted to the Town as soon as available, and not later than the close of the calendar year. Annual testing of electromagnetic emission shall be required to ensure continual compliance with the FCC regulations.

[3] B. W. G. (2012). *Bionitiative 2012: A Rationile for Biologically-based Exposure Standards for Low-Intensity Electromagnetic Radiation*

[4] McCarty, D. E., Carrubba, S., Chesson, A. L., Frilot, C., Gonzalez-Toledo, E., & Marino, A. A. (2011). Electromagnetic hypersensitivity: P Evidence for a novel neurological syndrome. *International Journal of Neuroscience*,121(12), 670-676

Abrami: I will let Kent speak to this. It really discusses that there should be something more than the average when we look at signal strength.

Chamberlin: this also has two parts. One is that it says you have to perform measurements on a cell tower. At one point you need to do that at commissioning because there are factors that can cause signals to be greater than what you would expect from simple calculations that the cell tower manufacturers provide. Burlington, Mass has a requirement as a town ordinance saying you have to perform these measurements regularly to make sure you have not exceeded guidelines.

The next part relates to how you perform those measurements. The way that's been done for fifty years is to look at averages. It turns out that it's not just the average power you're exposed to but it has to do with the transient nature of that and the summative effects. The way the measurements are performed now, if you were looking at a particular frequency, you would get a single value. It wouldn't see the contributing effects of nearby transmitters. The way I am proposing it here is that you look at the signals differently. You look at summative, the transient nature, the peak value which as I understand it, are not being looked at right now.

Wells: I am just noticing in this version, the second sentence after the bold section talks about focusing building terrain and antennas, but does not mention beam forming, which I think we discussed in one of the earlier sessions.

Abrami: I think you are right. Where are you?

Wells: The second non bolded sentence. You can put it after building, terrain, beam forming and antenna.

Heroux: Kent, this recommendation is very long. I wonder if somehow it could be a little bit remodeled to make it crisper to understand. All the other recommendations could almost be used in a commercial. Whereas this one, needs some wind to go through.

Abrami: I think you are right. Perhaps, some should be in the discussion part not the bold.

Gray: My objection to this recommendation is that it ought to be a subset of the study that you are requiring in recommendation one. If you found there is a problem, then how do you mitigate that problem?

Sherman: I kind of agree with Jim that this may be the cart before the horse. I don't disagree with this recommendation. I will vote for it but it would be great to have some parenthetical phrase somewhere in there that says depending on results of section one, or something like that.

Abrami: Ok. Why don't we say we are voting on the essence of this? Then we will vote again. I just want a sense of this. Is that ok with everybody?

Wells: You can streamline it by taking the first and last sentence in the bold and relegating the rest to the last paragraph.

Heroux: I would like to mention that this is very critical in the sense that this question is not something that will come out of a new investigation. It has been around for fifty years. The point here is that if you only look at biological effects over a gram and over averages, you blind yourself to reality. This is essentially what this very important recommendation says.

Abrami: I think that's why we have it here actually. I am ok with trimming it down and taking the middle part and moving it down below.

Woods: Just to clarify. We are trying to work this which is fairly complicated. Are we going to have another work session before the next full session?

Abrami: Yes. The work group is going to meet one more time because we have to talk about the rest of the report and get that going. Let's get the essence of a yes or no on this. If it's a no, we won't bother reworking it. We will have another vote specifically on this recommendation at the next full meeting.

Cooley: I will be voting no on this just because the FCC has its regulations in place here and they occupy the field. That's clear in both federal statute and federal regulation. Also, this is seemingly implying that wireless radiation is unsafe. Thank you.

Juvet: Mr. Chair, I would also like to let the commission that I will also be voting no on this. Again, this is making New Hampshire and outlier. This is a regulation that should be handled at the federal level. I think it sends a bad message about New Hampshire being serious about embracing the latest technologies for economic development.

Woods: As far as the consideration for New Hampshire being an outlier, I would like to point out that New Hampshire is the only state that does not have a mandatory safety belt law resulting in the loss of about 27 lives per year because of disuse. We have no trouble being an outlier in that regard. So I think that is perhaps something to consider the argument by itself to be an outlier perhaps should be put in a broader context.

Abrami: We all have our opinions. Ok. I move recommendation 6. This is just the essence, not the final words. We will vote on it one more time.

Chamberlin: I will second it.

Abrami: I am going to call the roll: Tom Sherman (yes), Ken Wells (yes), Kent Chamberlin (yes), Carol Miller (abstain), Denise Ricciardi (yes), Dave Juvet (no), Beth Cooley (no), Brandon Garod (abstain), Michelle Roberge (abstain), Paul Heroux (yes), Gary Woods (yes), James Gray (no), Patrick Abami-Chair (yes). There are 7 (yes); 3(no); 3 (abstain). The motion passes.

RECOMMENDATION 7- Require that any new wireless antennae located on a state or municipal right-of-way or on private property be set back from residences, businesses, and schools. This should be enforceable by the municipality during the permitting process, unless the owners of residences/business or school districts waive this restriction. Given these are local public rights-of-way and under the jurisdiction of a municipality, the Commission feels empowering individuals impacted by these antennae to be within states' rights to legislate such standards. This statute would return personal freedoms back to the individual in being involved with decisions as to non-essential devices that are being placed in front of their property.

Siting restrictions for cell phone towers already in force in the world were intended to ensure the safety of vulnerable populations, like children and those with illnesses. India already prohibits placement of

cell phone towers near schools or hospitals, and Canada (Standing Committee on Health), as well as many European countries, are looking into similar restrictions. In California, firemen have been exempted from the forced placement of towers on their stations, because of radiation health concerns.

There are plans to use higher frequencies in the future. These higher frequency transmitters have to take into account:

1. Less signal penetration into structures
2. The atmospheres oxygen and water absorption of radiation
3. The shrinking antenna apertures
4. The noise from multiple extraneous sources

For human users, this means increased power density exposures. In addition, exposures will become more irregular and originate from multiple sources (Multiple-Input-Multiple Output Architecture). As vulnerable individuals are exposed ever day in society to RF-radiation, limits should be universally applied, and set according to the Largest Observed Adverse Effect Distance (LOADE) using the experience from the past and current uses of 2G, 3G, and 4G technology, since there is no epidemiological experience with 5G.

An engineering practice would use a set-back requirement for new base-station cellular towers, including 5G micro-towers. A conservative LOAED should include all observed health effects. From the 18 papers abstracted in Appendix XX, shown in historical order, this set-back for all new cell towers should be 500 meters which translates to 1,640 feet. The actual set-back requirement should be established by the municipality based upon a balance of the science and reasonable accommodation for these antennae.

Abrami: Recommendation seven has to do with setbacks. I will let Paul speak to this one.

Heroux: There has been a lot of evidence in epidemiology that the proximity of cell phone towers enhances cancer effects that happen at the maximum within two years of installation as well as a variety of neurological effects that have been documented and so we believe that to bring densification to New Hampshire represents by itself a risk. Cell phone towers should be distanced from where people live whether they are vulnerable or not.

The non-bold section relays this information and says that there is evidence of health effects until 500 meters. In terms of best practice, this is what should happen.

Gray: This recommendation does not take into consideration any power level that is going out, beam forming or other things. If we are going to do this, it can't be all cell towers have to be .31 miles away. These new 5G are much less power. Unless you start to talk about power density and other measurements in recommendation 6, then this really has no meaning.

Cooley: As I expressed prior, this likely runs afoul of federal law. A state and locality cannot dictate where a wireless network can or cannot be built particularly if it creates holes in coverage and that is a barrier to entry. I will be voting no for that reason. I will also point out that there is a reference to California and that firemen were exempted from “forced” placement of towers. That is actually an incorrect statement. I have the legislative analysis that shows why the California firefighters were exempt from AB 57 many years ago. I would just submit for the commission that that is an incorrect statement. Thank you.

Heroux: 5G is something that is not yet defined and it will have beam forming which although the individual towers consumes less power, it has a higher effective radiated power because of antenna gain. So in the face of a new method of transmission, that is 5G that has yet to be defined by most people who deploy it, we can only rely on the past to assess the health impacts of cellular systems. In other words, we cannot be twenty years in the future to gauge as Senator Gray does suggest the health impacts of 5G. We can only use our experience of the past and this is what this distance is based on.

Sherman: I have to agree with Beth on this one. If we are going to leave this intact and I know it’s weakening your recommendation, but I would change the word “require” to “encourage” because I don’t think you can do this kind of siting or require it. It’s just a non-starter. I know that in Rye when we talk about a new cell tower coming in, which there needs to be and will be, that is a very productive negotiation between the town and Verizon and so I think “encourage” would be a way I could vote for this. Correct me if I am wrong, but I think Beth had it right that this is federal statute and we can’t do this. So, it’s a non-starter to put a recommendation that we can’t do.

Abrami: I don’t have a problem with encourage.

Sherman: I also want to make sure that we are accurate where Beth pointed out we were inaccurate. Maybe at the next subcommittee work session, be absolutely confident that you are correct in what you are talking about with California. If it’s not clear, I would remove it.

Abrami: Beth, can you send us your documentation on that please and I will share it with the whole group?

Cooley: Absolutely. It’s directly from the California legislature.

Juvet: Mr. Chair, in light of changing that first word in the bold from “require” to “encourage”, doesn’t that make the entire second sentence unnecessary? I don’t understand how the municipality will have the ability to enforce this.

Sherman: Dave, I think they can’t anyway. I would get rid of the second sentence. I just don’t think they have the ability to do this.

Woods: I agree with the comments about what is currently available legalistically. However, I think part of the concept of this report is what we think we would like to see obtained, a sort of wish list if you like. Then the actual application or translation into legislation would take these factors into consideration. I

have no trouble with the changes in view of honoring the legal aspect. But by the same token, I don't think we should shy away from stating what we think should be the standard and let that be heard.

Sherman: One way to do that would be to state the goal in your first sentence and then state in your second sentence how you would hope to get there.

Heroux: This could be done by the municipality.

Sherman: Well, as Gary said, you would need to have a statutory change probably at the federal level. So you could encourage. That's what we are doing in my town because we are working with the industry and it's actually going to be fine. So, one way is to encourage. The other way is to ask for Congress to change the law.

Heroux: I just proposed to say that this could be done by the municipality during the permitting process.

Sherman: I don't think they can do that right now.

Abrami: We will take that last sentence out and move forward with this.

Garod: I think I have to agree with Beth and Senator Sherman. I don't think there is anything wrong with encouraging municipalities to consider these factors when they are negotiating the placement of towers and when they are having a conversation about where it makes the most sense. But I think if you do anything that is seen as encouraging them to require a certain placement, the commission would be encouraging them to do something that is preempted by federal statute. I think the commission should stay away from any type of recommendation that suggests that municipalities have the ability to simply restrict where these towers are placed because I don't think they have the ability to do that.

Wells: Perhaps, when we revisit this in the workgroup, we can see whether this recommendation should be linked to recommendation one which calls for the delegation to look at the federal law.

Sheman: I think we are tight on time. Should we move to recommendation eight and agree that this needs work?

Abrami: Ok. No vote on number seven. The workgroup will work on it and maybe integrate it with another recommendation. The next time the full commission meets, we will vote on it.

RECOMMENDATION 8- Upgrade the educational offerings by the NH Office of Professional Licensure and Certification (OPLC) for Home Inspectors to include RF intensity measurements. Home Inspectors currently operate as private contractors who may be hired by citizens or enterprises to measure such things as radon, to collect water quality samples, or search for mold or insect damage. Home inspectors routinely supply test results to both their clients and government entities.

The majority of the Commission believes the public has the right to discover the RF power intensity related to radio frequencies at a property which they will be purchasing or renting before the

transaction is closed. Also, the proprietors of publicly accessible venues may wish to reassure the public about the RF power intensity within their establishments, by posting the data collected by a state-approved inspector. In addition, such testing should be paid for by the party requesting it and the testing itself should be performed by a professional who owns or rents the test equipment and has met the state requirements for training of Home Inspectors regarding RF measurements.

The majority of the Commission proposes that Home Inspectors be offered training by NH OPLC on how to measure on-site peak and 24-hour average RF intensities. Measurements of frequencies and intensities will be performed using low-cost equipment (such as GQ-390 meters). [Description of existing Home Inspector training offered for radon, mold, etc. may be seen at <https://oplc.nh.gov/home-inspectors/index.htm>]

Wells: This recommendation puts in place training for home inspectors that is offered then by the Office of Professional Licensure and Certification. Just as homeowners can request testing for radon or mold, they should be able to request testing for RF exposure on their property or prospective property and expect that the person doing the measurement has had training on the use of the equipment.

Abrami: the point is, we are not talking about making it mandatory. It deals with training inspectors to be able to do the measurements. So if someone has concern, if they are RF sensitive or whatever and they want they can go to somebody that's trained on how to do the measurements. This is totally different than the original recommendation eight. Several people had concerns with the original recommendation, myself included. If someone bought their home decades ago and cell towers were put up, there is nothing they can do to mitigate that problem. If an inspector found lead paint or a water problem, there are things they can do before the house is sold to mitigate that problem. This addresses that if someone wanted testing done, that inspectors are trained.

Gray: With this one, I am sure that Beth is going to tell me that this assumes that radiation is bad and all that. Again, non-mandatory, a state approved way to license. I don't have a problem with. They should have a reliable place to go to get those measurements from a qualified person might be a better way to go might be better.

Chamberlin: This is mostly on wording. In the second paragraph, the majority of the commission believes the public has the right to discover etc., and it says "at a property that they will be purchasing or renting before the transaction is closed". You know, that could be read as almost being a requirement before the sale, which it isn't. Also, it implies that the time when you could get testing done is when you are buying or selling something. I would like to keep it more general and that any citizen that wants this done, can call upon this service. Can we reword this so it makes it clear that it is voluntary and it is not necessarily tied to buying and selling of properties?

Wells: It should also be an option if you want as part of a building inspection as part of an agreement on something you don't own yet. There is nothing about requirement in there. The seller could say no. I refuse to have it inspected and go away and I will find another buyer.

Heroux: I might have been the one to have suggested this and the actual intention was to avoid bursts of demand as a result of some article and make the requirements for testing more evened out over time. I recognize that it's true, if you are buying or selling something, this might be a variable of interest.

Abrami: We are running out of time. I know a few of you have to go but I would like to vote on this one. Maybe the workgroup can work on the wording to make it clear it's voluntary. Is that okay?

Chamberlin: Yes. That addresses my concern.

Abrami: Then we can come back for another vote. Any workgroup changes will come back to the group for another vote. I move to vote.

Wells: second.

Abrami: I am going to call the roll: Tom Sherman (yes), Ken Wells (yes), Kent Chamberlin (yes), Carol Miller (abstain), Denise Ricciardi (yes), Dave Juvet (abstain), Beth Cooley (abstain), Brandon Garod (abstain), Michelle Roberge (abstain), Paul Heroux (yes), Gary Woods (yes), James Gray (no), Patrick Abami-Chair (yes). There are 7 (yes); 1 (no); 5 (abstain). The motion passes and will be revisited.

RECOMMENDATION 8A- The State of New Hampshire should begin an effort to measure RF intensities within frequency ranges throughout the state, with the aim of developing and refining a continually updated map of RF exposure levels across the state, using data submitted by state-trained Home Inspectors. The data should be collected in such a way as to identify geographic areas of notably high RF exposure, places where RF signal for wireless communication is inadequate (dead spots), and places where RF is unusually low (white spots) sought by people who wish to minimize their RF exposure. One possible use of this data will be buyers/renters of property or the public in general using benchmark values to make comparisons and make their own decisions based on their comfort level with RF exposure. After a while, an extensive New Hampshire RF database will exist to provide useful maps and data for future public health investigations. Appendix XX outlines in more detail the technical aspects of this recommendation.

Wells: So 8A is what we would do with the data that home inspectors come up with. One of the things would be that the State of New Hampshire would begin an effort to collect that data in such a way that we can identify geographic areas of notably high RF exposure and places where RF exposure is unusually low and this would be published in a database or a map. It could be used for future health investigations or for people who are looking for places with lower RF exposure.

Abrami: We are also talking about the state taking this on to actually do some measurements, itself. Am I correct on that Ken?

Wells: Yes. That could be a part of it. We talked about the way that Vermont did it. For the most part, this recommendation talks about a low cost way of assembling the data by collecting the data from licensed home inspectors.

Abrami: I can see that being added to the data. That would probably take a long time to get a real picture. The one thing we agreed on was we didn't want the general public taking their own measurements because there is no control.

Wells: It says here that the state of New Hampshire should begin an effort to measure RF intensities throughout the state. That does not preclude the state from having someone from the proper agency go around and take measurements.

Abrami: The essence is we want the state to look at the mapping of RF radiation and if recommendation 8 goes through, that data would be collected as well. These would likely be part of the same legislation.

Gray: My objection to this goes back to the state having to go through this. We haven't proven that there is a big problem yet. I would suggest that Kent work through the University system, get some grant funding and fund this thing. They can do all the studying and data recording and all the measurements that they want to but I don't believe that the state should be required to put together the organization to go do this. Thank you.

Cooley: I will be opposing this 8A as it tries to undermine safety standards that are set by the federal government with the potential to mislead residents that somehow RF within legal limits, is dangerous. So, I will be voting no. Thank you.

Sherman: Just to respond to Beth's comments. Actually, I don't think that's the case at all. Suppose if we find RF levels within the state that are exceeding federally acceptable levels. I am Chair of the Commission on chronic illness that has been standing since 2014 or 2015, looking at the link between human health and chronic illness. This kind of map is something we've been envisioning on all sorts of things. DES and DHHS are actually looking at this in relation to arsenic and bladder cancer and we've talked about expanding this. So these ideas of maps are not new. I think right now, it's a huge unknown. If the state of New Hampshire were to do this or if somebody were to develop a map, I think it would be very helpful. We may be surprised that we may have various RF exposure that far exceeds federal limits but right now, we don't have any clue what those levels are.

So, I don't think that is correct, Beth. I think that this would be useful information making sure that people are not unwittingly being exposed to levels that are beyond what our federal industry accepted levels.

Abrami: Again, we don't say in this recommendation that we are setting different levels.

Roberge: I would just echo what I have said previously. If this intention is that this recommendation be implemented by a state agency, then funding would be necessary. I don't know if you can build language in there similar to recommendation three.

Abrami: The state of New Hampshire "should fund an effort"...how is that?

Wells: I think this could be done in conjunction with the training of the home inspectors. If it's part of their training to do half a dozen measurements in locations the state is interested in.

Juvet: Mr. Chair, starting out that statement with the state of New Hampshire clearly implies it's the state.

Abrami: "The state of New Hampshire should fund or find resources to support the beginning of an effort to measure RF..."

Wells: I am not comfortable with that. One of the advantages of having the state do it, is that the state does not have a conflict of interest. I can imagine if there were entities that would have a conflict of interest and the data collected may not be believed by everyone.

Abrami: Right. We talked about this last time Michelle. Obviously, this isn't going anywhere unless legislation is passed. And if we want the state to do this, there would have to be funding as part of the legislation. It would have to have budget dollars associated with it. Again, this is more of a statement of what we would like to see happen.

Roberge: understood.

Abrami: I am going to say, just keep it the way it is. Is there any other discussion? I move recommendation 8A.

Wells: second.

Abrami: I am going to call the roll: Tom Sherman (yes), Ken Wells (yes), Kent Chamberlin (yes), Carol Miller (abstain), Denise Ricciardi (yes), Dave Juvet (abstain), Beth Cooley (no), Brandon Garod (abstain), Michelle Roberge (abstain), Paul Heroux (yes), Gary Woods (yes), James Gray (no), Patrick Abami-Chair (yes). There are 7 (yes); 2 (no); 4 (abstain). The motion passes.

RECOMMENDATION 9- Require all new cell phones sold in New Hampshire come equipped with updated software that can stop the phone from radiating when positioned against the body. The Commission has been made aware that cell phones contain proximity sensors that will allow a cell phone to only radiate signals when a certain distance from the body, for example, held in the fingers, or placed on a table. This does not change the functionality of the device, only the way it is used, specifically not held against the head or body. Implementation is a software update in the cell phone, as these phones already have a proximity detector to turn off the screen and soft keys when an obstacle is present. With this change, the screen and the RF circuit are automatically turned off. This removes the problems of brain cancers (glioblastomas and acoustic neuromas) and the issue of SAR limits for the industry. See Appendix XX for more detail references to the science behind this recommendation. Cell phones should come set with this inhibition, with instructions in the manual on how to disable it. There should be a soft button on then unit to easily re-enable the radiation inhibition, for example if the unit is handed to a child. In all cases, it should be easier to enable the restriction than to disable it. Cellular phones marketed specifically for children should stop radiating when positioned against the body under all circumstances. The installation of such proximity sensors is also encouraged in laptops and tablets.

Abrami: Number nine has to do with cell phones and I will let Paul explain it.

Heroux: Essentially, there is in cell phones a system that blanks out the screen when it's close to the head. This was originally intended to prevent the soft keys from being activated and the battery from being spent unnecessarily. This software could also interrupt the radiofrequency radiation so that when you bring it against your head so that half of the radiation that was previously broadcast into your head does not exist. In other words, you could use your cellphone exactly as before but you would need to hold it a certain distance from your head as instructed in most manuals sold with the cell phone. Or you could place it in front of your face or place it on the table for example.

Abrami: So the internals of the cellphone can do this with an app, is that correct?

Heroux: Either an app or a modification in the embedded code that is in the phone.

Cooley: since I had to drop early from our last meeting, I didn't get to speak on this recommendation. We are strongly opposed to this. Not only does science not require any of this. This is not necessary. The FCC has a 50 fold safety factor and there is no safety risk. I would be remiss not to point out Berkeley. The decision from last week in terms of compelled speech and First Amendment issues and I will just leave it at that and I will be voting no on this.

Sherman: I am just concerned that when we carve out New Hampshire as a different market from the rest of the entire world. To me, it's a little concerning. I am wondering if the intent here was to have this software that could be enabled by the user rather than something that would be inflicted on them. In other words, you go into your phone and you say I want this to automatically turn off when it's a certain distance of my body. You have activated that software and that keeps it a choice issue. I think that might be a little more doable. I worry about this one. I understand the intent and agree with the intent. But I wonder if making it enabling rather than mandating might be a better way to go.

Heroux: As it is, it is a choice of the user, you have to realize. Of course if you don't have the software in there to do this, you can't do it. In other words, every individual has the choice to accept this radiation when it's against their head or to reject it. We have discussed this issue of choice before. I believe Rep. Abrami brought it up and it was decided that adults should have the choice to use the phone and irradiate their brain if they wish but that the facility to subtract themselves from this radiation should be provided because it is technically very easy to do. In a sense, it is a negligence of industry not to have provided this before.

Heroux: So, Paul what you are saying is that this would have the software not activated but present so if the consumer chooses to use it.

Heroux: That is entirely right. If I may take off the gloves here.... The first thing that will happen from industry is that when the software is included, they will instruct all their sales force to do a favor to the buyer and say I will undo this for you. That's what I expect would happen because they do not want even this capability to be known. I think this is unfair to users.

Gray: If we continue to debate all of these instead of just accepting comments, we are never going to get out of here. My comment on this one is that on recommendation three, we are already putting out information on a site and using this as a hands free device which most cellphones do.

Abrami: the real essence of this recommendation is that it is possible to do this. I kind of agree with Tom. If it's true that most phones can do this, do we encourage entrepreneurs to come up with apps that allow people to buy and do this on their own? My understanding was that this existed in the phones, sensors. The question becomes would an app be allowed by a third party to be put on a phone to turn it off? There are many apps that go on phones, so I don't know. Do we need the cell phone industry to bless this or not?

Again, we are making a statement here. I would almost say "encourage"

Sherman: How about this wording? "Encourage that all new cell phones sold, come equipped with updated software that allows the user to automatically stop the phone from radiating when positioned against the body.

Abrami: It would be a tough sell in NH now that I think about it. There are some states with different emissions limits than others. The auto industry actually does comply with those different limits. California has different fuel standards.

Sherman: But California has a slightly different market share than New Hampshire.

Abrami: you got that right. We are the rounding error. But we like to be first in stuff though. So, with those two changes, any more discussion? I move recommendation nine.

Sherman: I will second.

Abrami: I am going to call the roll: Tom Sherman (yes), Ken Wells (yes), Kent Chamberlin (yes), Carol Miller (abstain), Denise Ricciardi (yes), Dave Juvet (no), Beth Cooley (no), Brandon Garod (abstain), Michelle Roberge (abstain), Paul Heroux (yes), Gary Woods (yes), James Gray (no), Patrick Abami-Chair (yes). There are 7 (yes); 3 (no); 3 (abstain). The motion passes.

Abrami: I know that Denise has to leave at a quarter after. A couple of hers are coming up here at the end. I know Gary has to leave too. I think what we may do ...

Woods: Mr. Chair I have number eleven and I think that should be pretty straight forward if you want to do it that way.

Abrami: I think we will do it that way. We will do one more, number eleven. I will just have to call another meeting. I said a potential of two more meetings so before I lose everybody, can we meet in two weeks? The 8th or the 9th?

Sherman: Why don't we do 10-11:30 on Thursday, October 8th?

Abrami: Ok. Subgroup I will reach out to you

Garod: I am sorry to be the one who jams everything up but I have a prescheduled meeting on the 8th at 11. I will be available for the first hour.

Abrami: We will book 1.5 hours but let's say it's going to be an hour meeting. If we just do the recommendation votes, we should be able to get that done in an hour. Let's just do number eleven.

RECOMMENDATION 11- Further basic science studies are needed in conjunction with the medical community outlining the characteristics of expressed clinical symptoms related to radio frequency radiation exposure. Further studies are just beginning to explore the quantum mechanical mechanisms which are the fundamental basis for understanding the biological changes occurring during the interaction of radio frequency radiation and molecules. These mechanisms can affect cells, tissues and whole organs, as well as accumulate over time.

The majority of the Commission feels the medical community is in the ideal position to clarify the clinical presentation of symptoms precipitated by the exposure to radio frequency radiation consistent with the Americans with Disabilities Act (ADA) which identifies such a disability. The medical community can also help delineate appropriate protections and protocols for affected individuals.

All of these endeavors (basic science, clinical assessment, epidemiological studies) must be completely independent and outside of commercial influence.

Woods: Basically, this just addresses the issue of further studies needed and addresses the issue of transitioning from what are called in the physics world, bulk materials to the actual quantum mechanical effects. We discuss these in a little bit of a peripheral way but have addressed such as proton tunneling and other similar quantum mechanical effects which really represents the way that all radiation interacts with molecular entities. That interaction is a base for cellular activity and as a consequence, also organ and overall systems activity. Those are really needed and they are just now coming on line. I think the bulk studies that have been done in the past, point out that we do need to look at this further. They were inconclusive for a variety of reasons. That's the inherent difficulty with bulk material studies especially when they are as complex as cells and organs. We need to encourage further looking at this.

Secondly, as this comes to the fore, there is a push in the medical community to identify exposure to these frequencies as a clinical entity. The State Medical Society and National Medical Societies are looking at this to try and colleague information in a way that will identify these as a potential designation of a syndrome. Indeed, the ADA already recognizes the exposure as a disability. I think it behooves the medical community to be thoroughly and completely engaged in this process to identify that dimension. So everything from the study, from the quantum mechanical effects which we've addressed to the clinical designation is needed.

Abrami: this is calling for the medical community to work on this. This one really has to do with RF sensitivity more than anything else. Gary is already beginning to reach out to the medical community to start addressing this in a more thorough way.

Woods: This is primarily meant for the readers of this report to identify that in fact there are other things in the works and we need to pay attention to those. The person reading the report will not only understand the other dimensions outlined in the other recommendations but that we as a commission recognize that this is a direction that we need to go and this is a direction that we need to go.

Sherman: I just had one little wordsmith in the first line. Gary would you object to after the word further" basic science and clinical studies are needed" so that it captures the full spectrum of basic science up to the clinical.

Woods: you could put it that way. The second portion of that, the medical community outlined that studies are needed in conjunction with clinical studies.

Sherman: Ok.

Cooley: I will be voting no on this. Take a look at the World Health Organization statement on this. That is why I will be voting no. Thank you.

Abrami: Any more discussion? Ok. I move recommendation eleven.

Heroux: I second.

Abrami: I am going to call the roll: Tom Sherman (yes), Ken Wells (yes), Kent Chamberlin (yes), Carol Miller (abstain), Denise Ricciardi (yes), Dave Juvet (no), Beth Cooley (no), Brandon Garod (abstain), Michelle Roberge (abstain), Paul Heroux (yes), Gary Woods (yes), James Gray (no) because I think it should be a sub of recommendation one, Patrick Abami-Chair (yes). There are 7 (yes); 3 (no); 3 (abstain). The motion passes.

Abrami: thank you all. As far as the Minority Report, Jim and I traded emails back and forth about whether a subcommittee is needed on the Minority Report. Joel doesn't think it's necessary but I know you had some concerns Jim about 91A stuff.

Gray: If you form a group, then I have to follow 91A and publicize the meetings and all those other things. If we don't have a quorum of the group then it can be informal. We can email back and forth and then present it to the group as a recommendation.

Abrami: those who want to sign onto the Minority Report, you can give your suggestions to Jim and correspond back and forth but there can't be meetings.

Gray: right. Forming a group would hinder me from writing the report. As long as I don't have quorum of the whole group or any committee of the group, then we can get together and talk about it because that small group cannot make decisions that are binding on anyone. Everyone should have a copy of what I wrote to begin with. I think Beth would like me to put at least a paragraph in there about the FCC and their requirements and I have no problem doing that. If other people want to communicate with me, just use my legislative email: james.gray@leg.nh.us. We will certainly publish it out through Pat to the rest of the group.

Abrami: I am ok with that. Joel's counsel to me was it was ok if you guys interact. I just wanted to make sure that was your understanding Jim.

Thank you everyone. I know some of you had to leave early. You know these commissions we have people from industry, it's very difficult to get unanimous on any of this stuff. That's why we are doing it the way we are doing it with the Minority Report. The legislature has recognized this and I ran into similar things with the Marijuana Commission. There were differences of opinion that could not be reconciled. The resolution that the legislature has is a Minority Report built into the total report so people don't miss it in fairness. So that is where we are at. We will see everybody in a couple of weeks.

V. Next meeting via Zoom: October 8th 10-11:30 am

Meeting Adjourned at 11: 27 am

Text chat during Zoom meeting:

Chat from HB522 5G Commission Meeting, Sept 22, 2020

From Rick Maynard to Everyone: 09:02 AM Morning All.

From Deb Hodgdon to Me: (Privately) 09:04 AM thank you

From Cece Doucette to Me: (Privately) 09:08 AM Morning, Kent. If the Recommendations document has changed from the one you sent me dated 9/17 in the file name, would you mind sending it to me?
Thanks.

From Me to Cece Doucette: (Privately) 09:09 AM We will be discussing the version that I sent you.

From Cece Doucette to Me: (Privately) 09:12 AM Supah, thanks!

From Cece Doucette to Me: (Privately) 09:29 AM Rec. 1, non-bold paragraph, first line: (TTA) should be (TCA)

From Cece Doucette to Me: (Privately) 09:42 AM Rec. 2 bold section, line two, in parentheses, (there) should be (their). Also, line 5, after "cell phones" might you consider adding, "and other wireless devices"?

From Helene to Everyone: 09:47 AM We are very concerned about having a cellphone tower being installed in less than 1/4 mile from the front of our home. We are listening to this meeting today so that we can be active in this process to ensure that residents of NH have a seat at the table to ensure that we have representation to protect our health and rights

From Rick Maynard to Everyone: 09:48 AM Thank-you all. Take care, I have to go.

From EH Trust to Everyone: 09:49 AM Published research o cell towers here <https://ehtrust.org/cell-towers-and-cell-antennae/compilation-of-researchstudies-on-cell-tower-radiation-and-health/> research on 5G <https://ehtrust.org/scientific-research-on-5g-and-health/>

From Helene to Everyone: 09:49 AM considering that we are currently in the process of dealing with our Town and a Wireless Tower company that gained approval in a way that we feel was not appropriate. None of the neighbors were included in the meeting and we are being told by the Town committee that we never would have had any say in the tower being approved because of the current laws in our State, regardless of our concerns

From EH Trust to Me: (Privately) 09:51 AM Can I record please . It is a public meeting. I requested to record

From Cece Doucette to Everyone: 09:52 AM Rec. 3, at the end of the bolded section, please consider adding after "pregnant women" the other vulnerable populations, "the elderly and those with existing health compromises."

From Me to EH Trust: (Privately) 09:54 AM I'm not able to grant permission to record during an active meeting. However, verbatim minutes will be posted on our public website.

From EH Trust to Me: (Privately) 09:56 AM Thank you, I thought it was an open meeting so we could
From Helene to Everyone: 10:01 AM The biggest concern is that they are allowed to put numerous antennae on top of the towers which can increase the emf emissions greatly. Please consider this.

From Cece Doucette to Everyone: 10:13 AM Do we have long-term studies on Li-Fi? Perhaps we can modify the bold where it says, "optical connections" to "optical connections if proven biologically safe."
Rec. 5, second unbold paragraph, please be careful about recommending LEDs, many suffer negative biological effects from them today.

From Helene to Everyone: 10:17 AM Here is a caveat; we have a cell tower going up in less than one mile from 2 schools. What good is converting over to broadband or fiber optic technology (which is not only better, but less risky for security purposes) when there is a cell tower with 10 - 20 antennae located so close and children are exposed 5 days/week for 6-8 hours per day. Health concerns are not only for children, but all people are susceptible to emissions. Many towns are now electing to not install towers due to the findings from many studies and the notable increased health risks

From EH Trust to Everyone: 10:32 AM You can watch a news investigation that shows it was lobbying from firefighters here https://www.youtube.com/watch?v=61h_vuBujw0&feature=emb_title Affidavit of Susan foster <https://ecfsapi.fcc.gov/file/7022117660.pdf>

From Helene to Everyone: 10:32 AM Should we remind everyone that the FDA has approved numerous medications in the past as SAFE, but they were not. Tobacco and asbestos were considered safe and they were not. We have evidence from other countries that this technology is not safe, yet it is being

shoved down our throats and to comment that NH would be an outlier is wrong and uninformed. Thank you Dr. Heroux for pointing that information out. There should be several regulations implemented keeping towers from close proximity to residential homes, schools and businesses. There are OTHER safe options available and people should have the right to say NO to unsafe technology, especially until it is found to be made safer.

From EH Trust to Everyone: 10:35 AM Resources on firefighters here <https://ehtrust.org/firefighter-unions-opposing-cell-towers/>

antennas on forestations were carved out of the bills Fire stations AB57- Firefighters have gotten an exemption to have cell towers on or adjacent to their facilities. This was codified in California's 2015 legislation AB57 . CA AB57 (2015) Legiscan Text of Bill. " Section 65964.1. (f) Due to the unique duties and infrastructure requirements for the swift and effective deployment of firefighters, this section does not apply to a collocation or siting application for a wireless telecommunications facility where the project is proposed for placement on fire department facilities. " SB649- They also received an exemption in California's SB649 (2018), a bill which was vetoed by Governor Brown. SB 649 California (2017) Wireless Telecommunications Facilities – 65964.2. "(a) A small cell shall be a permitted use subject only to a permitting process adopted by a city or county pursuant to subdivision (b) if it satisfies the following requirements:(3) The small cell is not located on a fire department facility."

From Cece Doucette to Everyone: 10:35 AM You can replace the firefighter passage with: Please note, in 2004 the International Association of Fire Fighters adopted a formal Position on the Health Effects from Radio Frequency/Microwave (RF/MW) Radiation in Fire Department Facilities from Base Stations for Antennas and Towers for the Conduction of Cell Phone Transmissions. They oppose them, "until a study with the highest scientific merit and integrity on health effects of exposure to low-intensity RF/MW radiation is conducted and it is proven that such sitings are not hazardous to the health of our members." They reaffirmed that stance in California's 2017 Senate Bill 649 which would take away municipal home rule to place more wireless infrastructure in our communities, on poles in the public rights of way, at street level every 4 to 12 homes. They included an exemption in the bill: Section 2 "65964.2. (a)...(3) The small cell is not located on a fire department facility." Every citizen should have the same protections.

From EH Trust to Everyone: 10:36 AM The news investigation details the fire fighter position. You can watch it all here https://www.youtube.com/watch?v=61h_vuBujw0&feature=emb_title

From NR to Everyone: 10:38 AM New Hampshire does have the legal right to "require" those setbacks. According to the TCA of 1996 -- 47 U.S.C. § 332(c)(7)(B)(i)(I) is very clear: in only prohibiting discrimination between "providers of functionally equivalent services." "Functionally equivalent services" are defined as those wireless services functionally equivalent to those being provided by the "personal wireless service facilities" for which approval is sought. Therefore, a county zoning ordinance that imposed different and stricter procedural requirements (e.g., conditional use) on wireless service facilities than on facilities used for providing fiber to the home, cable TV, utilities, or other services would not be in violation of the law. Moreover, 47 U.S.C. § 253 does not prohibit the county from

imposing stricter procedural requirements on WTFs than on cable or other uses of facilities. Section 253 has three relevant parts. Section 253(a) creates the general rule that "[n]o State or local statute or regulation, or other State or local legal requirement, may prohibit or have the effect of prohibiting the ability of any entity to provide any interstate or intrastate telecommunications service". In turn, subsections (b) and (c) are "savings clauses" that provide safe harbors to protect the ability of states and localities to regulate zoning and construction of wireless facilities:

From NR to Everyone: 10:38 AM (b) State Regulatory Authority

Nothing in this section shall affect the ability of a State to impose, on a competitively neutral basis and consistent with section 254 of this title, requirements necessary to preserve and advance universal service, protect the public safety and welfare, ensure the continued quality of telecommunications services, and safeguard the rights of consumers. (c) State and Local Government Authority Nothing in this section affects the authority of a State or local government to manage the public rights-of-way or to require fair and reasonable compensation from telecommunications providers, on a competitively neutral and nondiscriminatory basis, for use of public rights-of-way on a nondiscriminatory basis, if the compensation required is publicly disclosed by such government. From Helene to Everyone: 10:41 AM Yes, Rep Abrami. Exactly what we are going through right now. From GARY WOODS to Me: (Privately) 10:41 AM will you be able to forward the "chat" to us? From Helene to Everyone: 10:42 AM Cell tower will be erected within the hot zone of our home and we are being told that we have NO rights

From Deb Hodgdon to Me: (Privately) 10:46 AM kent see chat on state rights

From EH Trust to Everyone: 10:49 AM You can see how Switzerland measures RF and posts it fr all to see here

<https://map.geo.admin.ch/?topic=funksender&lang=en&bgLayer=ch.swisstopo.pixelkartefarbe&layers=ch.bakom.mobil-antennenstandorte-5g,ch.bakom.radio-fernsehsender,ch.bakom.mobilantennenstandorte-gsm,ch.bakom.mobil-antennenstandorte-umts,ch.bakom.mobil-antennenstandortelte&catalogNodes=403,408>

From Me to GARY WOODS: (Privately) 10:51 AM Yes, I'll forward the chat after the meeting.

From Cece Doucette to Everyone: 11:03 AM

Most kids don't use cell phones against head, but they do have their cell phones, tablets and laptops on their bodies. Please expand this to all wireless devices, not just cell phones.

From EH Trust to Everyone: 11:05 AM Phones exceed RF limits at body contact My daughter uses the phone to her head. I think it should be for al wireless devices as well. Many lawyers and politicians and coaches use cell phones to their head. and most people carry phones touching their body and in bras

From Cece Doucette to Everyone: 11:17 AM Doctors, nurses and others can be trained January 28-31 at the EMF Medical Conference. There are IDC codes already established and in use today. There is an EMF primer offered October 23-24. Health care providers and the general public are invited to register for both. <https://emfconference2021.com/>

WHO has reopened their investigation into in 2020 based on recent science showing cancers, reproductive issues and other effects: https://www.who.int/peh-emf/research/rf_ehc_page/en/index1.html

From EH Trust to Everyone: 11:20 AM The Who EMF Project has no transparency as published research shows here <https://www.spandidospublications.com/10.3892/ijo.2017.4046> Whereas The Who IARC is independent and scientists are vetted for conflicts of interest Our scientists letter to the EHO about the “factsheets” they post online was never answered <https://ehtrust.org/scientists-call-for-transparency-at-the-world-health-organization-emf-project/> The Who refuses to answer these questions

From Cece Doucette to Everyone: 11:22 AM Yes, just like the FCC refuses to answer this Commission's questions.

**NH COMMISSION TO STUDY THE ENVIRONMENTAL AND HEALTH EFFECTS
OF EVOLVING 5G TECHNOLOGY**

Meeting held:

10/8/20

10:00 am-12:00 pm EST

Via Zoom (<https://unh.zoom.us/j/8760768986>)

Via telephone-US (1 312 626 6799 (US Toll) ID: 876 076 8986)

In attendance: (13)

Rep. Patrick Abrami-speaker of the house appointee

Rep. Ken Wells- speaker of the house appointee

Kent Chamberlin-UNH-appointed by the chancellor

Denise Ricciardi-public-appointed by the governor

Michele Roberge-DHHS- Commissioner of DHHS appointee

Dr. Paul Heroux- Professor of Toxicology, McGill University- speaker of the house appointee

Rep. Gary Woods-speaker of the house appointee

Senator Jim Gray-president of the senate appointee

Senator Tom Sherman-president of the senate appointee

Brandon Garod-AG designee, Asst. AG Consumer Protection

Bethanne Cooley-CTIA , trade association for wireless industry and manufacturers

Carol Miller-NH Business & Economic Affairs Dept

David Juvet-Business and Industry Association

Not present: (0)

Meeting called to order by Rep Abrami at 10:03 am

Abrami: Due to the Covid 19 virus and the Executive order signed by the Governor this public meeting is allowed to be conducted via Zoom. It is open to the public for viewing and was duly posted as a zoom meeting. With that said, if you are not a member of the Commission, can you please turn your cameras off and mute yourselves? That would be much appreciated. In addition the meeting is being recorded as an aid to doing the minutes. All chat room discussions will be included in the minutes.

I. Approval of minutes from 9-22-20:

I have not received any changes to the minutes that I sent out about a week ago. Are there any changes that anyone wants to make? Seeing none, I will say ...without objection, we approve the minutes from that meeting.

II: Agency Disclaimer:

I sent out the agency disclaimer that will be in the report. That is there especially for the agencies. I think I heard back from two of you. I can't recall if I heard from all three of you. My sense is that the language is okay with your leadership. I think most of you took it up the pole to your leadership. I think you are all okay with that language. I am looking at Michelle, Carol and Brandon. Yes? Ok. So, we are good there. That language will appear in the report.

III: Vote on Recommendations (6,7,8,10,12,13,14):

Some of these recommendations we voted on but said we would change some of the wording so we are going to go back to them, discuss them and take another vote. We may have to revisit #9 as well. The work group changed some of the wording.

I would like to work backwards so Brandon can at least hear the discussion on the ones we have not discussed before and be involved in that vote. I sent the updated document out. It's the document dated October 5th in the upper right hand corner. We will start with Recommendation #14. Denise, that was yours.

RECOMMENDATION 14- The State of New Hampshire should engage our Federal Delegation to legislate that under the National Environmental Policy Act (NEPA) the FCC do an environmental impact statement as to the effect on New Hampshire and the country as a whole from the expansion of RF wireless technologies. Concern comes from the fact that the FCC is projecting that 140,300 low orbit satellites, 800,000 5G small cell antennae plus many additional macro towers will be required for these networks to function.

The majority of the Commission is concerned that any new large-scale project that will densify antennae networks to this extent truly requires an environmental impact study. The NEPA statute requires that the agency consider environmental concerns in its decision-making process. NH should be provided documentation of such considerations. Until there is Federal action, NH should take the initiative to protect its environment.

Ricciardi: We had discussed doing something about the environmental impact with the expansion of wireless technology. The reason I addressed it is because we have an act: the National Environmental Policy Act (NEPA). That statute requires that the agency consider environmental concerns in their decision making process. New Hampshire should be able to request for documentation to be provided of such considerations for the impacts on our environment. That's why I wanted to use this NEPA to reflect that.

Abrami: Any discussion? I don't see anyone. Ok. Without any discussion, I will move to vote. We will take the votes as we did the other day. Is there a motion to accept the recommendation?

Cooley: Mr. Chair, before we do that. Are you guys getting feedback?

Abrami: Yes. Someone is not muted. Please mute yourselves. Thank you, Beth. I was hearing that as well. The static is gone now.

Ok. I need a motion that we accept the recommendation.

Ricciardi: I make the motion that we accept recommendation #14.

Chamberlin: I second it.

Sherman: Are we going to have discussion on this, Patrick?

Abrami: Yes. I did ask for discussion.

Sherman: I just want to clarify one word and that is "fact" in the second sentence. We have seen the citation that the FCC is projecting 140,300 low orbit satellites. Is that from an FCC publication? I just want to be sure that that is a verified fact and that the FCC has stated that.

Ricciardi: It is a fact that Ajit Pai stated that the FCC estimated 800,000 wireless facilities for 5G. That, I know for sure.

Wells: Yes, the 14,300 is the number I have heard associated with the SpaceX operations. There is a citation for the 800,000 in the chat.

Sherman: I just want to make sure that we have the documentation if someone asks, is that truly a fact? This has come up on other recommendations. If you have the documentation that the FCC has projected that, then I am fine with it the way it is.

Ricciardi: Yes and I am sending it. I am trying to make sure I don't miss anybody.

Gray: The relevance of this...are we saying that the radiation from those satellites are going to cause damage to people, DNA, heating, all of those things? Yes. There may be that many satellites but what relevance does that have to our committee? It's like the thing that you sent out the other day about Van Halen having a metal guitar pick and he attributing that to his cancer and discounting all of the smoking that he did for years and years. A lot of this stuff, although may be interesting, it is just anecdotal. It is not a fact. It is not good science. It is not worthy of being talked about and reported in the minutes of these meetings. Thank you.

Woods: I understand the Senator's comment on the relationship and how this recommendation #14 does not make that direct connection. This is basically an assessment of the degree to which the level of radiation is increasing. The rest of the report relates to the basic science. This does not address basic science and its relationship to cellular or organism impact. But, just a documentation of the prevalence and so in that sense, I think it should remain.

Abrami: The third piece of this was additional macro towers to make the networks function. I would imagine without much stretch of the imagination, there would be more macro towers. I know we got

the low orbit satellites from somewhere because originally we had 140,000 and Ken, I think it was you who said, it's 140,300.

Wells: I can look for a link on the satellite numbers.

Heroux: the point of the recommendation is that the FCC is avoiding a NEPA review, while modifying the environment substantially. It doesn't qualify the consequences, it just says that the US formality is that is normally fulfilled, has not been, by the FCC.

Abrami: Ok. While Ken is looking for that, let's hold on the motion and move to #13.

Wells: I found a news article from March of this year that the FCC has approved up to a million small cell antennae for the Starlink network.

Woods: If I could clarify that Ken said antennae but the question was about satellites.

Abrami: Ken you keep looking. We will skip this one for now. Denise, please speak to #13.

RECOMMENDATION 13- The State of New Hampshire should engage agencies with appropriate scientific expertise, including ecological knowledge, to develop RF-Radiation safety limits that will protect the natural environment; trees, plants, birds, insects, and pollinators.

The majority of the Commission understands that current Federal safety limits set twenty-four years ago with the intention of only protecting humans from short term effects, but not protecting flora or fauna from harm. The State of New Hampshire needs to ensure our natural environment and wildlife are protected by effective safety standards. Tree limbs, birds, and pollinators will be closer than humans to 5G cell antennae and associated 4G densified infrastructure. In fact, the wireless radiation from cell antennae could exceed safe limits when leaves of trees and flying birds and, since they may have higher exposure being in direct line of sight of wireless RF beams. When pollinators are impacted so are all forms of vegetation that depend on them for reproduction. Research on this issue is shown in Appendix XX.

Ricciardi: We all discussed that the State of New Hampshire should engage agencies with the appropriate scientific expertise including ecological knowledge to develop RF radiation safety limits that will protect the natural environment: trees, plants, birds, insects and pollinators. I like this recommendation.

Abrami: I prefer that we have a discussion before we move to vote in case there are some slight modifications that we can agree to. I will open this up to discussion.

Heroux: I thought we had agreed to remove the word "environment" and use the word "ecology".

Abrami: Yes. We did. What we agreed to was " including ecological knowledge".

Heroux: I think you should remove environment from there entirely and put: trees,plants, birds, insects and pollinators.

Abrami: get rid of “natural environment” is that what you are suggesting?

Heroux: yes.

Gray: One of the key things you cited is data from twenty three years ago. There is also both FDA and FCC guidance that have been promulgated on this that’s dated in ‘18, ‘19 and ‘20 where they state that they have reviewed the current science and nothing like that is even mentioned in this recommendation. Again, I think you are giving the opposing argument short shrift on this and not considering all the science that is out there.

Sherman: could I say something? Senator Gray and I and everyone in the legislature, understands that federal limits and regulations may not necessarily reflect the latest science. The most recent example of this is the EPA and their regulations on PFAS, which still is at 70 ppt. No scientist worldwide would say that is adequate protection. So, we actually had a bill that we passed asking the DES through their science and toxicology to go ahead and come up with maximum contaminant levels.

I, for one, always find it a little fascinating for us to say: well let’s just trust the federal government to do the right thing when we know they are not necessarily doing it. If we want to wordsmith the second paragraph, that’s fine but I think there is absolutely zero harm having the scientists that are part of our state already and we have great ones at DHHS and DES to take a look at the science and perhaps come up with their own recommendations for guidelines. Not only is there legislative and statutory precedent for this kind of thing, we have selective trust of the federal government when it comes to these scientific matters. We have generally erred on the side of saying: well, let’s take a look at it ourselves. I would say, let’s vote on this one and move on.

Ricciardi: Thank you, Senator Sherman.

Gray: Again, I am not saying you are not going to put this recommendation in. I am saying that you say the guidance out there is 23 years old, but you don’t mention the documents from ‘18, ‘19 and ‘20 that affirm that they have conducted reviews that are of the current data that is out there. Unless you are going to treat both sides fairly, then the report you get at the end has no meaning.

Abrami: If you read on, it says with the intention of only protecting humans from short term effects. Obviously the first studies were done on humans, not birds, plants, insects and pollinators. I am ok taking the 24 years out but as Tom said, even with that, the state doesn’t necessarily trust what the federal government has done.

Sherman: Mr. Chair, I have a fairly straightforward wordsmith that hopefully addresses Jim’s concern. It could say: “the majority of the commission understands that current federal safety limits were made with the intention of only protecting humans from short term effects” They have looked at subsequent science but they are the same so we don’t have to get into that. We can just capture that by saying the intention.

Abrami: right. Thank you for helping with that one. That was my feeling.

Sherman: If there is no further discussion, we should move. We have to keep moving.

Abrami: we are up against a time clock here. That's why it may appear that I am rushing.

Roberge: Just a recommendation. In recommendation #1, we are asking our federal delegation to require the FCC to look at the standards with respect to human health. I am wondering why we wouldn't ask for them to look at the environmental impacts as well. An example of that was in my previous job at DES, that at the EPA looking at the Clean Air Act and standards set by EPA, there is a primary health based standard and a secondary environmental standard on things like sulfur dioxide and nitrogen oxide. I am just suggesting that we add this on for recommendation #13.

Abrami: We had it separate to highlight that only human effects have been considered and I would like to keep it separate.

Cooley: Just a comment and I don't me to belabor the point but this is more so for the minutes. States do not have jurisdiction to set their own RF safety limits. That is the exclusive jurisdiction of the FCC. For that reason, I will be voting no on this recommendation.

Abrami: Again, this is only to have the state study if it so wishes. This would be just like Tom was saying; the state took the initiative to look at PFAS a little more closely. That's what we are doing here. We are trying to add to the knowledge base.

Ricciardi: in 2018 and 2019, statements by the FDA are not about the birds, trees, and bees. If you look at the FDA reports, they are only about tumors not environmental effects. As we said before, these are just recommendations by our commission. Recommendations, do not go against the law as Senator Sherman said, you would put legislation forward. With all due respect to everyone here, there is the minority report. I don't feel that we should be constantly changing the one that the majority feels when there will be a minority report. Thank you.

Gray: Again, Denise has her opinion. The thing is that this report should have the fair and equal treatment of both sides of this issue. In paragraph one, you claim to have a fair and equal treatment of both sides. Yet, on this recommendation before it was modified, you spoke to the 23 years and ignored recent documentation issued by both the FCC and FDA. The FDA as far as I know is not in the business of protecting the environment. I agree with that. But, then we didn't go look at other guidance out there to see if it was relevant. All we are asking for is fair and equal treatment. There are experts that we would like to present but we have not been able to do that because of time considerations and scheduling problems with those experts.

If you are going to just put through recommendations on this issue that I feel are far and above what should be done without looking at both sides of the science, then I might as well sign off this call and resign from the commission because it's not doing me any good and it's not doing the citizens of New Hampshire any good. You guys rail road this thing through. Fine. But we are not protecting the citizens of New Hampshire and not providing the economic opportunities that a good and useful cell phone system will provide them. It's just very frustrating.

Abrami: Again, we lost four months due to the virus. I had a lot more speakers lined up and I kept saying to Beth, come up with more speakers. There is no changing our end date on this.

Sherman: Mr. Chair, I just want to make sure the Jim knows that I hear what you are saying and the way these commissions work is we try to be very respectful to everyone's opinion. We move forward as much as we can together and the minority report is for any additional dissent or altering opinion. But Denise, I think it's very appropriate for us to modify the final recommendations to fit as many people on the commission as possible. I fully support making the change that Jim wanted which was getting rid of the years and the timeline in the comment below. I hope we can move forward and bring this to a vote.

Ricciardi: I appreciate that and I understand. It's just the subcommittee has worked over and over again all these iterations. But I do thank you for your comments.

Abrami: any other questions or comments on this? I would like to take this one to a vote.

Sherman: I am happy to move it to a vote.

Heroux: I second.

Abrami: It's going to be as shown and taking out the "natural environment" in bold and taking out "set 24 years ago" and adding "limits were made with the intention", in its place. We will go over all these changes and do a final vote before we do a vote on the report. I will call the roll:

Tom Sherman: yes

Ken Wells: yes

Kent Chamberlin: yes

Carol Miller: abstain

Denise Ricciardi: yes

David Juvet: No, and I would like to comment. This implies that the state is going to be implementing its own RF radiation safety limits which I think will invite a lawsuit. I can't support it.

Beth Cooley: no

Brandon Garod: abstain

Michelle Roberge: abstain

Paul Heroux: yes

Gary Woods: yes

Jim Gray: no

Pat Abrami: yes

Abrami: The motion passes, 7 yes, 3 no, 3 abstain.

Any information on the numbers for satellites, Ken?

Wells: Elon Musk has approval for 42 thousand but there are other satellite companies like OneWeb but I don't know what the total number is. I would be fine if you want to remove that number of satellites or just talk about the 42 thousand that SpaceX has been approved for their Starlink project.

Abrami: I remember seeing articles when we first started this that there were two or three companies, I think. If somebody could help me with that, I would appreciate it.

Heroux: You could put that the exact number will be updated by FCC documents. We know it's going to be at least forty three thousand and it may be higher but I don't think that people will vote yes or no on the basis of the exact number of satellites but rather on the impact of all these things.

Abrami: We can vote on the number as written with the intention that we find and have documentation for it and all of these in the appendix and we can modify 140,300 low orbiting satellites before the last meeting.

Sherman: I would recommend the following: I would take the sentence that starts with concern and unbold it and put it in the discussion. And change the part: concern comes from the FCC projection of numerous low orbit satellites and 5G small cell antennae plus additional macro towers that will be required for these networks to function. You still need documentation in there.

Wells: Citation 53 and 57 talk about FCC license approved.

Heroux: The satellite network is something very fluid. Some of these companies go bankrupt. Essentially, there is a large uncertainty but I think that when the FCC mentions 800 thousand, it is their number and it brings home the impact on the environment because "numerous" could be five. Five is not equal to 800 thousand. When we have a number that originates with the FCC, maybe it shouldn't be in bold because it doesn't refer to a principle but at least it should be in the text underlying, in my opinion.

Gray: Again, the purpose of this commission is to study health and environmental impact. Are we saying that every one of those satellites is affecting health or the environment? No. That's not possible. The FCC has issued further guidance about whether there is a health effect and has said that they have studied the current science out there and current reports that have been done by other people. Not including a reference in this and many of the others to the fact of what the current position of the FCC is, is one sided and not a fair and balanced part of the report. You can say whatever you want but we need to present the facts on both sides, not the facts on one side. Trying to use the number of satellites, the number of antennae, the number of this, the number of that and saying that that is going to affect your health or the environment is purely trying to do fear mongering. Present the facts on both sides.

Abrami: Let's not forget that we wrote to the FCC and the FDA questions that they did not answer. We would love to have had them testify before us as well but that was not going to happen. They would not even answer our questions.

Gray: the guidance is already there on the internet. I went and found it when I was preparing the current minority report.

Ricciardi: It's a captive agency.

Sherman: I would just point out that if you look at the recommendation, it is not drawing any conclusions, Jim. It's asking for further study. I don't think it's necessary that you have to say anything when all you are asking is for further study so I disagree with you on this one. I do agree with Paul that if you want to put a number in there that is a little more dramatic than numerous, you just need to be sure that you have the source of that number documented. I am fine with a number as long as its source is documented.

Woods: I agree that we should move forward with this. This is basically an assessment tool of identifying prevalence. It's probably no different than the technology of putting roads in a hundred or so years ago. We didn't have roads or bridges and did not have to repair them. But now, we need to assess roads and identify how many bridges we have that need repair. We are now in a different technology, wireless and like roads and bridges we are trying to identify how many we have. We are not saying bridges or roads are bad. We are trying to do an assessment of the prevalence of these items so that when we look at whether they need attention or not, we will have some idea. Again, it's like trying to assess how many bridges we have not whether they are good, bad or indifferent.

Wells: From a physics point of view, the number of antennas is relevant because if you have tens of thousands of satellites and hundreds of thousands of small cell antennas and they are all emitting energy, the energy density is increased by a factor of the number of antennas.

Abrami: Tom's suggested language moving it from the bold section to the explanation portion. Why don't we do that and between now and the next meeting, if we can verify hard numbers we can put them in the report. Is there any other discussion? Kent made motion to move the recommendation. Denise seconded it. I will call the roll:

Sherman: no vote (not on screen)

Wells: yes

Chamberlin: yes

Miller: abstain

Juvet: no

Cooley: no

Garod: abstain

Roberge: abstain

Heroux: yes

Wells: yes

Gray: no

Abrami: yes

I don't see Tom on the screen, so I will not count him. 6- yes, 3 -no, 3 -abstain. Motion passes.

RECOMMENDATION 12- Recommend the use of exposure warning signs to be posted in commercial and public buildings. In addition, encourage commercial and public buildings, especially healthcare facilities, to establish RF-radiation free zones where employees and visitors can seek refuge from the effects of wireless RF emissions.

Many NH citizens are sensitive to electromagnetic radiation emitted from devices used in the delivery of in-building cellular, and fixed wireless services. A majority of the Commission suggests owners of commercial and public buildings, especially healthcare facilities, voluntarily place signage at entrances concerning RF-levels and RF-free zones within these structures so those entering the building are aware.

Miller: It's a simple recommendation for exposure signs to be posted in commercial and public buildings especially in healthcare facilities. This is also to establish RF radiation free zones where employees and visitors can seek refuge from the effects of the emissions. It's a pretty simple recommendation. Some folks are doing it already. I can say that dentist's office tell you to shut your cell phones because it does disturb the equipment. There it is and ready for discussion.

Gray: Are we going to include the report from the World Health Organization that says exposure to this low level of radiation is not a factor and has not been scientifically tied to any syndrome? Is that going to be included at all?

Miller: I don't know. If you think that would balance off this recommendation and would like it in the appendix, I have no problem with that at all. Regardless of whether it's based in science or not, there are many citizens that are sensitive to it. It's as simple as that, for me anyway.

Gray: Again, I am just trying to be fair. There are people out there who say they are sensitive to it but there is no scientific tie in double blind studies that confirm that these people are actually suffering effects of the radiation.

Heroux: and these people don't believe that.

Miller: Right and it's just a recommendation. It's not required. We can add some NH citizens are sensitive.... Regardless of the study and add the appendix note with that. However, you think the justification for the bolded statement addresses both sides. You could put after the words: fixed wireless services.... even though not substantiated through the World Health Organization Report.

Abrami: The lead in to all these recommendations is we are following the Precautionary Principle. All of these would need NH legislative approval. The work group thought this was a reasonable recommendation to make, understanding that it's a high lift to get it through the legislature and the Governor to sign. We can add a line or two but Jim, you have the minority report. I know what you are going to say about this one. You already told us.

Juvet: Just a question for people more knowledgeable about this than me. What exactly is involved with businesses establishing RF free zones? What do they have to do in order to create that?

Miller: We had some examples where hospitals have rooms available for folks that were bothered by the electromagnetic radiation. It's not just from antennas. It comes from computers and a variety of places. I have experienced a customer coming into my business going, "whoa, I can feel everything in here". That was one of hundreds that come in.

Juvet: I am just asking for clarification. You could use hospitals as an example. What did they have to do to create that RF free zone?

Wells: From the physics point of view, you build a Faraday Cage. It's a lightweight metal lined box. It could be similar to a screened porch with metal screening or aluminum foil. Repaper the wall with aluminum foil and you are good.

Heroux: What you can do is survey the environment for the place where the fields are lowest and post signs that you don't want active sources that are controlled by individuals and you may do this at a very low cost. As Ken mentioned, you could also actively try to shield if you have some sources that are very powerful that you want to get rid of in that location.

Abrami: We have somebody who is RF sensitive who says, my oral surgeon was very happy to move me to a lower RF room and make sure no one had devices in the room.

Sherman: I think there is an easy fix on the sentence but I just want to caution Jim or others about citing any traditional or organized medical site like WHO or otherwise... that because they say it isn't so, that it isn't so. I am old enough to have been and I know others will recognize this but when I was growing up in Madison, people who had fibromyalgia syndrome or symptoms or irritable bowel symptoms were actually told by doctors, it's all in your head and come to find out, it's not. Studies were inadequate. They missed the boat. Eventually, when we got the studies together, we recognized not only that the symptoms real and reflected a true syndrome, but now they are mainstream diagnoses. The fact that RF sensitivity is not fully recognized nationally or internationally, doesn't mean a thing to me.

What I would say is "many NH citizens report sensitivity to electromagnetic radiation" and leave it at that. That's the reality. I suspect this will turn out to be a real well-documented syndrome eventually.

The science is so much in its infancy right now. I would be very cautious about saying it doesn't exist. I suspect that it does and we don't have the studies yet to prove it.

Abrami: Our recommendation #11 directs the medical community to start looking at this more rigorously. I am ok with that change.

Gray: It still does not recognize that there have been scientific experiments conducted by the WHO that was supposedly double blind and all the great things we are supposed to do when we do one of these studies that said they cannot, and not to be insensitive to people who are suffering, but they couldn't attribute it to electromagnetic radiation.

Sherman: I would just respond to that Jim, no physician in their right mind would depend upon a single study to say that something does or does not exist or that a treatment does or does not work. Would you agree with that, Gary?

Woods: Absolutely, we have seen as Tom has outlined time and again over the course of hundreds of years, theories have been thrown out on a regular basis for a variety of reasons. This is just one more in that long term step. We went through this with tobacco and we are doing the same thing again. In the chat there are some references for the WHO organization the Jim refers to. The people in the chat seem to be more familiar with it than I. There are two portions of the WHO organization. Some are associated with industry and some are not. It has been pointed out, as we have pointed out in this commission, one of the WHO organization provided the conclusion that radio frequency radiation was indeed a Class II carcinogen. So to say that a WHO organization says there are no effects, would not be inclusive of all the WHO organization findings.

Gray: Saying that it is a carcinogen, it doesn't take into consideration what the level of that radiation is. The FCC's recommendations are 50 times less than what has been demonstrated in various studies. To say that it's a carcinogen, yes at certain levels it is. When we treat cancer and have multiple doses of radiation going into a patient, we do it at different aspects so the tissue in between is not affected. To make that statement without some kind of a radiation limit, doesn't bode well for me.

Sherman: Mr. Chair, can we move the question?

Abrami: Are there any other comments? Ok, let's move the question. The only change is in the descriptor, "many NH citizens report sensitivity". Tom, are you making the motion?

Sherman: yes.

Abrami: second?

Heroux: yes.

I will call the roll:

Sherman: yes

Wells: yes

Chamberlin: yes

Miller: abstain

Ricciardi: yes

Juvet: abstain. I appreciate that this is a recommendation and not a mandate. On the other hand, I am uncomfortable with sentences like “many NH citizens”. I don’t know what “many” means in the context of the overall state population so I am on both sides of this one.

Cooley: abstain.

Garod: Brandon had to leave. He is gone.

Roberge: abstain.

Heroux: yes

Woods: yes

Gray: no

Abrami: yes

7- yes, 1-no,4- abstain. Motion passes.

We are going to go to #10.

RECOMMENDATION 10- Promote and adopt a statewide position that would strongly encourage moving forward with the deployment of fiber optic cable connectivity, internal wired connections, and optical wireless to serve all commercial and public properties statewide.

The majority of the Commission believes that fiber optic transmission is the infrastructure of the future. When compared, RF wireless transmission lacks fiber optic characteristics: speed, security, signal reliability and biological effects on humans and the environment.

The State should encourage partnerships between towns to make this happen and encourage our Federal Delegation to support grant money to assist with such deployments when it comes to funding fiber optic cable deployment especially in rural locations.

Abrami: This is really a shout out to fiber optic connectivity.

Miller: It is simply adopting a statewide position, not a body but a position that strongly encourages moving forward with deployment of fiber optic connectivity, internal wired connections and optical

wireless to serve commercial and public properties statewide. That would just mean hard wired connections or optical wireless as opposed to Wifi. Open for discussion.

Heroux: I am very in favor of this. I think in the modern world, having fast access to the internet is a human right nowadays. This should be done in the most technologically advanced way, which is optical fiber. There is both a technological aspect to this and a human aspect. I think this is very important.

Juvet: just a quick comment. I am actually prepared to vote for this recommendation because the BIA believes in an "all of the above" approach for technology and communication. My question is in the text, when you talk about comparisons with RF wireless transmissions, we are only mentioning things that don't compare well with fiber optics. I am wondering if there are any advantages to wireless and if there are, shouldn't that also be mentioned?

Abrami: The advantage would be mobility.

Miller: Well, not only mobility but cost. Being able to distribute wireless connections is a lot cheaper than hardwiring connections.

Wells: The recommendation talks about fiber optic cable and in other recommendations, we talk about wireless optical transmission. The major advantage RF has is its not tethered. It is possible to do optical without being tethered. But that's not built into this recommendation but appears elsewhere.

Abrami: Well, yes it is in here.

Wells: oh yes. Now I see it. You are right.

Heroux: Lifi (optical wireless) has advantages of privacy over radio frequency or microwave (Wifi) which is very leaky from the privacy point of view.

Cooley: I just want to note for the record that I will be voting no on this. We see this as discriminatory and it doesn't take into account the realities of geography, topography and economic realities that may limit the ability to provide fiber. By removing one type of technology altogether like wireless, you could be exacerbating the digital divide and removing options for consumers to connect. Thank you.

Sherman: I just found one tiny point. I feel like the grammar police here but in the sentence with "biologic effects in the human environment, doesn't make sense to me. The way I would say that is, "RF wireless transmission lacks fiber optic characteristics including speed, security and signal reliability while avoiding potential biologic effects on humans and the environment.

Abrami: Yes, you are right. I agree with you.

Gray: I have less of a problem with this recommendation with that change but it still assumes there is an effect on humans and the environment. We are picking one technology over another that I am not sure I am comfortable with.

Sherman: I would just add Jim, you are not picking it, but the majority of the commission feels this way.

Gray: and as Senator Sherman knows, the people who elected me elected me to voice my opinion and speak strongly in their defense.

Abrami: we respect that Jim.

Woods: This doesn't say anything about the biological being good or bad. It just says avoids it. Because when you have radiation in the environment, there will be an effect on humans. It's like measuring the bridges. We are just being cognizant that in fact, this is an exposure.

Juvet: Just a request from the commission. In my reading of this, the promotion of fiber is not meant to exclude the development of Wifi but Beth makes a good point. Is there some way in the recommendation that we could add the words, "where practical"? This would recognize that a lot of areas of this state, we recognize the benefits of that but it's just not a practical option.

Abrami: I have no problem with that.

Juvet: I would insert "where practical" and delete, "to serve all commercial and public properties statewide".

Wells: I just want to note, is it practical to put electricity in commercial and public properties? You are talking about exactly the same type of installation for fiber optic.

Abrami: I think the practical consideration David was talking about was cost.

Wells: I am thinking of the Rural Electrification Act. You know it's surely more expensive to supply service in low density areas, yet broadband is as necessary these days as electricity and running water. I don't see that adding "where practical" in here is a necessary or a desirable qualifier.

Miller: Even though I will abstain from the vote on this and have written this, I think the idea behind this... as far as cell service and all of that, everything has its place. This particular recommendation really starts to get at the infrastructure of the future which regardless of mobile technology and everything else is where New Hampshire needs to go. However you decide to wordsmith it, I would not like to see the essence of that recommendation be diluted by it. That's my thought even though I will be abstaining.

Heroux: I agree with Carol and I would like to point out that in some recommendations we talk about the majority of the commission. We start the recommendation this way. I wonder if this wording is appropriate. Why is it in some recommendations and not others when we will probably report how many people voted for it and how many voted against? I don't see any recommendation in this report that will be unanimous.

Sherman: I am just reflecting. As Ken was saying, maybe rather than using "where practical", and say "wherever possible" captures what Carol was saying. It also captures the idea that if you can get electric in there, you can get fiber optic in there. Even the top of Cannon Mountain has it. If you are on top of Mount Washington and all you have is cell service and there is no electric and you are living on kerosene

lamps, then maybe it's not possible. Practical can mean if it is \$10 more to put in fiber optic, maybe it's not practical because you already have cell. I think putting in "possible" captures the spirit of what Carol was saying and also captures what Ken was saying. I am just putting it out there.

Abrami: I guess the one I have to ask is Dave.

Juvet: I would prefer practical. The senator says possible and what if it's ten thousand dollars more? Anything is possible if you want to devote enough financial resources to it.

Miller: I wanted to go back and respond to Paul's comment about the majority of the commission. I think we coined that phrase because of Senator Gray and the fact that we don't have 100% consensus on a lot of these recommendations. It's nothing more than that.

Abrami: we have three options. Either don't change it; possible; or practical.

Juvet: Mr. Chair maybe I can make it easier on the commission and perhaps we should just be voting on the original wording because I think it's going to get difficult if we are trying to find out which wordsmithing we are more comfortable with. I am not sure it will change people's votes, ultimately. I would like to withdraw my recommendation and we can just vote on the original wording.

Abrami: Ok. Thank you for that. What we are changing is, "while avoiding potential effects".

Wells: I would like to move that.

Woods: second.

We are voting on recommendation #10.

Sherman: yes

Wells: yes

Chamberlin: yes

Miller: abstain

Ricciardi: yes

Juvet: no

Cooley: no

Garod: absent

Roberge: abstain.

Heroux: yes

Woods: yes

Gray: no

Abrami: yes

7- yes, 3-no, 2- abstain. Motion passes.

Juvet: Mr. Chair, I do need to drop off the zoom meeting now because I am leading one that starts in about two minutes. Thanks everyone for all their work on this but I do need to leave at this point.

Abrami: Before you go, we are thinking of a meeting on Tuesday, the 27th one o'clock for at least two hours.

Juvet: I am available on the 27th.

Abrami: Can anyone not make that? I will check with Brandon.

Ok moving backwards now to #8.

RECOMMENDATION 8- Upgrade the educational offerings by the NH Office of Professional Licensure and Certification (OPLC) for Home Inspectors to include RF intensity measurements.

Home Inspectors currently operate as private contractors who may be hired by citizens or enterprises to measure such things as radon, to collect water quality samples, or search for mold or insect damage. Home inspectors routinely supply test results to both their clients and government entities.

The majority of the Commission believes the public has the right to discover, on a voluntary basis, the RF power intensity related to radio frequencies at a property which they will be purchasing or renting before the transaction is closed. Also, the proprietors of publicly accessible venues may wish to reassure the public about the RF power intensity within their establishments, by posting the data collected by a state-approved inspector. In addition, such testing should be paid for by the party requesting it and the testing itself should be performed by a professional who owns or rents the test equipment and has met the state requirements for training of Home Inspectors regarding RF measurements.

The majority of the Commission proposes that Home Inspectors be offered training by NH OPLC on how to measure on-site peak and 24-hour average RF intensities. Measurements of frequencies and intensities will be performed using low-cost equipment (such as GQ-390 meters). [Description of existing Home Inspector training offered for radon, mold, etc. may be seen at <https://oplcnh.gov/homeinspectors/index.htm>]

Cooley: Mr. Chair, my notes say that language was supposed to be inserted making this voluntary.

Gray: My objection to this one is that we are putting it on the Office of Professional Licensure and Certification to go and do something. I don't think we need the State of New Hampshire to do that at all.

Abrami: Beth, we did add that if you go to the second paragraph..."on a voluntary basis".

Gray : if it's a voluntary program then OPLC shouldn't have to do that, take some advocacy group and develop the thing and get certified through the advocacy group. I don't think it needs to be a function of the state.

Sherman: Mr. Chair, I move that we adopt this recommendation as written.

Ricciardi: I second it.

Abrami: Ok. Let's go to the vote:

Sherman: yes

Wells: yes

Chamberlin: yes

Miller: abstain

Ricciardi: yes

Juvet: absent

Cooley: abstain

Garod: absent

Roberge: abstain.

Heroux: yes

Woods: yes

Gray: no

Abrami: yes

7- yes, 1-no, 3- abstain. Motion passes.

RECOMMENDATION 7- Require that any new wireless antennae located on a state or municipal right-of-way or on private property be set back from residences, businesses, and schools. This should be enforceable by the municipality during the permitting process, unless the owners of residences/business or school districts waive this restriction.

Local public rights-of-way are under the jurisdiction of municipalities, and the Commission feels that municipalities should uphold the rights of individuals impacted by antennae. The Commission also supports the right property owners to manage decisions on non-essential devices being placed in front of their property.

The Commission believes that it is important to prioritize citizen safety, particularly as 5G is an upgrade, rather than the provision of wireless service to unserved areas. Additional rationale for this recommendation shown in Appendix XX.

Abrami: #7 was rewritten after objections by Beth on the California firefighters. That was in the write up.

You sent us all the California Senate amendments. They say that “due to the unique duties and infrastructure requirements for swift and effective deployment of firefighters, those provisions do not apply to co- location or siting application for telecommunication facility where the project is proposed for placement of fire department facilities.” This is my read on this, they are carving out the fire stations and the reason that they give is totally different from all the background history that says health effects.

They said it had to do with them interfering with their duties, not that it’s health effects. They basically said having towers on top of the building is going to interfere with the swift and effective deployment of firefighters. To me, that’s a sleight of hand what they are saying here. They are trying to skirt the federal law with this. To me, it’s a wink and a nod. Is that the way you read this, Beth?

Cooley: You can just read the statute itself. You can imply intention or read into it all you want but the statute itself says it’s got the FCC language in there that you know that states and localities cannot consider RF emissions or the alleged health effect as a reason to deny a facility. You have to read the statute as is. You can rely on innuendo or fake news coverage all you want but that’s really all I have to say.

Abrami: What I don’t understand is how does the cell tower on the roof impact the duties for swift and effective deployment of firefighters? I don’t understand the logic.

Cooley: you have to read the statute in conjunction with the fact they are honoring federal law,

Abrami: That’s the only way they can honor federal law. They are not going to say what the real issue was. The real reason was fire fighters fought hard because of health effects. We don’t have the time digging into the logic of California legislature on this other than to get around the federal law and appease the firefighters. I would ask that question.

Ricciardi: If you want, I can send you documents on how they lobbied on health effects.

Abrami: we know there are documents on health effects but this is the only way they could skirt federal law. If the FCC really wanted to take this on, they could. How does a cell tower on your roof impact the swift deployment of firefighters?

Cooley: Mr. Chair, I don't think it changes the essence of the recommendation. I will be voting no and you guys all know that. Your setback requirements are unlawful and essentially a prohibition of service. Even if you conceded the California topic, which I am not, you read the statute as it's written. You still have the underlying recommendation which is incredibly problematic.

Gray: The bottom line of this is that there is a federal preemption. Whether or not there is a California law to do something, it doesn't matter. There is a federal prohibition against us doing that. That's the bottom line and this recommendation should not be in the report.

Abrami: California proves that you can do a carve-around. That's what I am seeing here. They have carved out a certain set of people. That's the way I view it.

Sherman: I just want to move to accept the recommendation as written.

Chamberlin: I will second it.

Sherman: yes

Wells: yes

Chamberlin: yes

Miller: abstain

Ricciardi: yes

Juvet: absent

Cooley: no

Garod: absent

Roberge: abstain

Heroux: yes

Woods: yes

Gray: no

Abrami: yes

7- yes, 2-no, 2- abstain. Motion passes.

Abrami: Ok. We took number six and split it into 6A and 6B.

RECOMMENDATION 6A- Signal strength measurements must be collected at all wireless facilities as part of the commissioning process and as mandated by state or municipal ordinances. Measurements are also to be collected when changes are made to the system that might affect its radiation, such as changes in the software controlling it. Signal strength is to be assessed under worst-case conditions in regions surrounding the tower that either are occupied or are accessible to the public, and the results of the data collection effort is to be made available to the public via a website. In the event that the measured power for a wireless facility exceeds radiation thresholds, the municipality is to be empowered is to be immediately have the facility taken off line. The measurements are to be carried out by an independent contractor and the cost of the measurements will be borne by the site installer.

It is recognized that theoretical calculations show that existing FCC guidelines will be met by standard cell tower configurations. However, there are cases where the radiation from towers can be focused by buildings, terrain, and beamforming antennas, causing signal levels to be considerably higher than would be expected in theoretical calculations unless those effects are taken into account. Collecting field measurements provide the only valid approach for determining whether exposure guidelines have been met. It is to be noted that some municipalities (e.g., the town of Burlington, MA [1]) have ordinances requiring measurements at cell towers.

Federal Law and NH law grant to municipalities the power in enact zoning rules regulating the placement of personal wireless service facilities within the geographic boundaries of the municipalities. Municipalities should be proactive in this area and through the exercise of zoning power establish where, how, and a process for compliance with existing FCC guidelines for signal strength in the surrounding coverage area. Municipalities should establish a hierarchy of siting values and compliance acknowledgements so that the siting most favored by the municipality is the easiest siting for the wireless applicant to obtain and conversely the siting which is least desirable should be the most difficult siting for the applicant to obtain. The zoning ordinance should lay out the compliance requirement as part of the zoning approval.

[1] Burlington, MA zoning Bylaw Wireless Facilities Section 8.4.6.2 "Annual RF emissions monitoring is required for all sites by an independent RF engineer to be hired with Planning Board approval and at the applicant's expense. Test results will be submitted to the Town as soon as available, and not later than the close of the calendar year. Annual testing of electromagnetic emission shall be required to ensure continual compliance with the FCC regulations.

Chamberlin: We split this into two separate recommendations. The change made to 6A was to add that municipalities can take the antenna off line if it exceeds thresholds. It's one thing to take measurements but what do you do about it if it's an issue? It also mentions that these measurements will be taken by an independent contractor with the cost to be borne by the site installers. This only addresses requirements that measurements be performed on the facility. We might want to discuss that first because there is a part that Carol put in also talking about the control of the facility by the municipality.

This part was added by Carol.

Federal Law and NH law grant to municipalities the power in enact zoning rules regulating the placement of personal wireless service facilities within the geographic boundaries of the municipalities. Municipalities should be proactive in this area and through the exercise of zoning power establish where, how, and a process for compliance with existing FCC guidelines for signal strength in the surrounding coverage area. Municipalities should establish a hierarchy of siting values and compliance acknowledgements so that the siting most favored by the municipality is the easiest siting for the wireless applicant to obtain and conversely the siting which is least desirable should be the most difficult siting for the applicant to obtain. The zoning ordinance should lay out the compliance requirement as part of the zoning approval.

Miller: This language comes from some presentations and attorney recommendations for towns. It simply says that federal law and NH law grant to municipalities the power to enact zoning rules regulating the placement of personal wireless service facilities within the geographic boundaries of their municipalities. The municipalities should be proactive in this area. Through the exercise of zoning power establish where and how and a process for compliance with existing guidelines for signal strength in the surrounding coverage area. They can establish a hierarchy of siting values and compliance acknowledgements so that the siting most favored by the municipalities is easiest siting for the wireless applicant to obtain. Conversely, deciding which is least desirable should be the most difficult siting for the applicant to obtain. The zoning ordinance should lay out those compliance requirements as part of that zoning approval. It's just legalese legal speak for what the municipalities can indeed control within their realm. Is there any discussion about that? It comes from Donahue, Tucker and Ciandella which does a lot of work for municipalities across the state with regard to cable franchises and wireless siting and all of the above.

Cooley: That new language is concerning to me because it's a clear outline of how to put up obstacles for deployment. So a municipality is saying we want this site here over this one but the municipality has no idea where coverage is needed or where there are coverage holes. That language is quite concerning to me.

Gray: the problem I have with this one is you start off by talking about signal strength and being able to shut down a site. If the facility is operating within the FCC goals, I don't think you have the ability to do anything after that site has been established. And then we moved to this paragraph which talks about siting the thing. That's very concerning. I can't think of powers here in the city of Rochester that have gone through the planning and zoning process that haven't gotten a favorable decision because of the strength of the law giving the FCC certain responsibilities.

Abrami: It assumes that the limits are above the FCC guidelines.

Heroux: Cultural acceptability of these installations and social acceptability to the people who use them is very important and critical in my opinion.

Abrami: I don't see anything wrong with us saying the municipality can measure whether sites are within federal guidelines. If they are not, we are saying action can be taken by the municipality. That's all it is saying.

Ricciardi: I just want to remind everyone that we are here to make recommendations based on what we have learned over the course of all of these months and that is what we are doing. We wrote long questions to the FCC, FDA, EPA. We did not get answers. They did not want to present. So we are using from the presenters, from the science and from what we read, to make recommendations to help residents in the state of New Hampshire. That's our job of this commission. This is just a recommendation based on our findings. It's not a law.

Abrami: my concern is that right now, we put three or four cell towers near each other, how do we know, who is the policeman on this? Maybe Beth knows this answer. Is the industry out there taking measurements making sure they are within federal limits?

Cooley: I don't have a clear picture on that so I don't want to say publicly. I have heard different things from different members of mine but I can look into that. I can follow up.

Gray: I wanted to comment on Denise's comment about the questions that were sent to the FCC. Many of the issues she raised are already available on the FCC and FDA website. For a commission member to send a letter off that did not even come from the whole commission in an approved list of questions to the FCC doesn't meet the common sense test in this instance. That information is available. Maybe they did not respond to Denise's letter...ok? Is the information that Denise asked for available on their website? Yes. I went in and found it. We are not citing a lot of that information anywhere in our report.

Ricciardi: "We" gave specific questions that are not answered on the website. They did not answer them and those are the answers to the question we were truly seeking to find.

Abrami: I did review them before she sent them out and we shared them with everyone. We can go round and round on this one. Let's bring it to a vote. I need a motion.

Heroux: yes.

Wells: second.

Abrami: Ok. We are voting on 6A.

Sherman: yes but I have five minutes and then I have to leave at noon.

Wells: yes

Chamberlin: yes

Miller: abstain

Ricciardi: yes

Juvet: absent

Cooley: no for the hierarchy siting language and I also need to leave at noon.

Garod: absent

Roberge: abstain.

Heroux: yes

Woods: yes

Gray: no

Abrami: yes

7- yes, 2-no, 2- abstain. Motion passes.

Abrami: let's try to do 6B. Were there any changes to this one?

Chamberlin: the only change that was made addresses taking new measurements that takes into account the impulsive nature of radiation and the summative effects. What was asked for in the last meeting of this group was that we take some of the references and put them in the appendix and that's all that we really did on this one. I also mentioned that the development of those funding protocols should be funded by the appropriate federal agency like NIH, FCC etc. We are in the process of creating more references that support the statement that it's impulsive radiation more than continuous radiation that has the deleterious effect on humans. That's the change and is in compliance with what was asked in our previous meeting.

Gray: again the FCC I believe in the spring of 2019 addresses a lot of these topics in there. They reviewed the science and found these effects are not true. You don't have any of that information in this report that is anti to the opinion of the majority of the group.

Abrami: if no more discussion, I would like to get a motion on this one and vote before the two leave.

Chamberlin: So moved.

Heroux: Second.

Sherman: yes

Wells: yes

Chamberlin: yes

Miller: abstain

Ricciardi: yes

Juvet: absent

Cooley: no because of the alleged assumption of negative health effects.

Garod: absent

Roberge: abstain.

Heroux: yes

Woods: yes

Gray: no

Abrami: yes

7- yes, 2-no, 2- abstain. Motion passes.

Abrami: I think that's it. I am going to have to pull this all together. I will rely on Joel to help me pull pieces from one place to another and I will get it to you as soon as I can. I asked the work group to pull together the appendices that go with these recommendations. The work group will meet once before the final meeting and possibly reorder these in some logical way without losing the numbering.

Jim: as soon as I know the order, I will tell you and give you a map.

Gray: It doesn't appear we will have time if you aren't meeting until the 27th. We only have a few days to do the minority report.

Abrami: I was assuming you would be working on the minority report in parallel based on the recommendations.

Gray: we have been trying to do that but every time we get changes getting it back through the people on the minority report is becoming a problem. Again, we will do our best.

Abrami: ok. The date is November 1st. If we need a little wiggle room we might be able to get it. Just because we are meeting on that date does not mean we won't have the report out to everybody before that date. Ok Jim? A lot of this is going to fall on me and Joel to get it pulled together. I will try to get it to you a week ahead of that date so you can see what it looks like before then.

Gray: and I will do my best to get the thing to you as soon as I can.

Abrami: I know Jim. We are all under pressure having to campaign at the same time.

Workgroup next meeting: Monday, the 12th 10am-12 pm. Kent, will you set that up and the other one as well?

Chamberlin: yes.

Abrami: ok very good. Thank you.

IV. Next meeting via Zoom: October 27th 1-3pm

Meeting Adjourned at 12:03 pm

Chat from HB522 Commission October 8, 2020 Meeting

From EH Trust to Everyone: 10:15 AM

800,000. We'll need an estimated 800,000 new cell sites by 2025.

<https://docs.fcc.gov/public/attachments/DOC-354323A1.pdf>

REMARKS OF FCC CHAIRMAN AJIT PAI
WHITE HOUSE 5G SUMMIT
WASHINGTON, DC
SEPTEMBER 28, 2018

Research showing impacts to trees sent to fcc here Testimony of Albert M. Manville, II, Ph.D., C.W. B., and Principal, Wildlife and Habitat Conservation Solutions, LLC, on Behalf of Friends of Amazon Creek, Before the City of Eugene City Planning Department in Opposition to AT&T/Crossfire's Application for a "Stealth" Cellular Communications Tower in the Upper Amazon Creek Corridor / Testimony-of-Albert-M.-Manville-for-Amazon-Creek.pdf Testimony of Albert M. Manville, II, Ph.D., C.W. B., and Principal, Wildlife and Habitat Conservation Solutions, LLC, on Behalf of Friends of Amazon Creek, Before the City of Eugene City Planning Department in Opposition to AT&T/Crossfire's Application for a "Stealth" Cellular Communications Tower in the Upper Amazon Creek Corridor / Testimony-of-Albert-M.-Manville-for-Amazon-Creek.pdf

From EH Trust to Everyone: 10:20 AM

<https://ecfsapi.fcc.gov/file/10718080685516/Testimony-of-Albert-M.-Manville-for-Amazon-Creek.pdf>
Trees <https://ecfsapi.fcc.gov/file/1001669617135/Trees-in-Bamberg-and-Hallstadt-Documentation-2006-2016.pdf>

more on trees damaged <https://ecfsapi.fcc.gov/file/1001669617135/RF-Radiation%20injures%20trees%202016.pdf>

Published study A review of the ecological effects of radiofrequency electromagnetic fields / A review of the ecological effects of radiofrequency electromagnetic fields (RF-EMF)
<https://ecfsapi.fcc.gov/file/7520939746.pdf>

Published study Impacts of radio-frequency electromagnetic field (RF-EMF) from cell phone towers and wireless devices on biosystem and ecosystem – a review

<https://ecfsapi.fcc.gov/file/7520943486.pdf>

Impacts to insects from higher frequencies that are to be used in 5G. Here is a paper

<https://ecfsapi.fcc.gov/file/1210030663890/Exposure%20of%20Insects%20to%20RadioFrequency%20Electromagnetic%20Fields%20from%202%20to%20120GHz%205g%20.pdf>

From Cece Doucette to Everyone: 10:21 AM

Rec 13: Line 5, need to insert the word "were" between the words "limits" and "set".

From EH Trust to Everyone: 10:26 AM

The FDA info does not include ANY review of impacts birds or bees in fact the FDA only looked at tumors and their “literature review” was only on tumors, not bees, not trees, not birds

See the details on the FDA here <https://ehtrust.org/expert-physicians-surgeons-and-scientists-call-for-fda-to-retract-biased-anonymous-report-of-cancer-impacts-of-cell-phones/>

These documents by the FDA have nothing to do with trees or birds or wildlife.

No, the EPA was defunded in 1996 AND never looked at environment

The letter I sent you from the EPA shows that pollinators and trees and plants have NEVER been looked at

From Ken Wells to Everyone: 10:28 AM

“Starlink “ wiki cites reports of FCC approvals for up to 42,000 Starlink satellite antennas:

<https://en.wikipedia.org/wiki/Starlink>

From EH Trust to Everyone: 10:29 AM

Statement from Dr. Albert Manville on the FDA Report on Cell Phone Radiation

<https://ehtrust.org/press-statement-from-dr-albert-manville-on-the-fda-report-on-cell-phone-radiation-2/>

From Cece Doucette to Everyone: 10:30 AM

The FCC is being sued for not addressing the scientific literature submitted to them showing biological affects: The Environmental Health Trust and a coalition of other commentators in 2020 also filed a court appeal challenging the FCC’s order terminating its evaluation of the adequacy of FCC RF radiation limits.

<https://ehtrust.org/action-alert-lawsuit-against-the-fcc/>

Robert F. Kennedy, Jr.'s Children's Health Defense is also suing the FCC for negligence:

<https://childrenshealthdefense.org/news/robert-f-kennedy-jr-s-childrens-health-defense-submitted-historic-case>. Additionally, Dr. Jeffrey Shuren of the FDA has serious conflicts of interest, his wife is a partner in a law firm that represents the wireless industry: <https://www.5gcrisis.com/shuren-petition>

From EH Trust to Everyone: 10:40 AM

The EPA letter that is on your record shows there is no standard for the environment. See it here the EPA letter <https://ehtrust.org/epa-birds-bees-trees-5g-wireless-effects/>

Environmental Health Trust is suing the FCC . Read the brief here <https://ehtrust.org/eh-takes-the-fcc-to-court/>

Please be sure to read the NRDC brief that showcases the lack of review regarding environmental impacts here <https://ehtrust.org/wp-content/uploads/20-1025-NRDC-amicus-brief.pdf>

This Amicus brief also has the letter from the EPA that says What US agency has reviewed the research on damage to trees from cell phone radiation? If so, when was it issued and send a link to the review. Note this study showing damage from long term exposure to cell antennas. EPA Response: The EPA does not have a funded mandate for radiofrequency matters, and we are not aware of any EPA reviews that have been conducted on this topic. We do not know if any other US agencies have reviewed it. Published research can be found here <https://ehtrust.org/environmental-effects-of-wireless-radiation-and-electromagnetic-fields/>

From Cece Doucette to Everyone: 10:41 AM

Senator Gray and others, you may wish to review the Mobile Communications and Health study commissioned in 2000 by T-Mobil, the German parent company of T-Mobile. It concluded there are many non-thermal biological effects well below public radiation exposure limit levels. They recommended specific precautionary measures should have been taken, but they were not and the industry continued to market hazardous products:
<https://docs.google.com/viewer?a=v&pid=sites&srcid=ZGVmYXVsdGRvbWFpbnx1bmRlcnN0YW5kaW5nZW1mc3xneDo3MTE4NThkYmY3NmUzMzc0>

From EH Trust to Everyone: 10:43 AM

Theodora Scarato of EHT asked “What US agency has reviewed the research on impacts to birds and bees? If so, when and send a link to the review. I will note the latest research showing possible impacts to bees from higher frequencies to be used in 5G.” July 8, 2020, Lee Ann B. Veal Director, Radiation Protection Division Office of Radiation and Indoor Air, Environmental Protection Agency of the United States of America responded “EPA Response: The EPA does not have a funded mandate for radiofrequency matters, and we are not aware of any EPA reviews that have been conducted on this topic. We do not know if any other US agencies have reviewed it.” Link to letter here <https://ehtrust.org/epa-birds-bees-trees-5g-wireless-effects/>

Statement by Wildlife Biologist Alfonso Balmori, BSc on the FDA Review of Cell Phone Radiation and Cancer

The FDA review omits an evaluation of the science on wireless radiation impacts to trees and wildlife. Electromagnetic radiation is a form of environmental pollution which may hurt wildlife. I am providing examples of my published research below as examples of this scientific evidence. Read the letter with studies at <https://ehtrust.org/26684-2/>

From EH Trust to Everyone: 10:47 AM

The FCC has NOT studied the issue. In fact they are using the lack of response by agencies to “prove” there are not effects.

From Jen White to Everyone: 10:47 AM

I second the comment above!!

From Cece Doucette to Everyone: 10:48 AM

Senator Gray and others, please read Harvard Law School's Center for Ethics report, "Captured Agency: How the FCC is Dominated by the Industries it Presumably Regulates." It likens FCC and industry approach to the tobacco industry tactics: <https://ethics.harvard.edu/news/new-e-books-edmond-j-safra-research-lab>

From EH Trust to Everyone: 10:53 AM

Research shows that the levels of RF will be increased with 5G infrastructure 4G densification . As an example of how rapidly RF is increasing from wireless antennas, a 2014 published study looked at RF in three European cities and found in just one year (between April 2011 and March 2012) that the total RF-EMF exposure levels in all outdoor areas in combination increased by 57.1% in Basel by 20.1% in Ghent and by 38.2% in Brussels (Urbinello 2014). “Exposure increase was most consistently observed in outdoor areas due to emissions from mobile phone base stations.”

<https://www.sciencedirect.com/science/article/pii/S0013935114002254>

2018 study published in Annals of Telecommunications found increased RF-EMF exposure from small cell LTE networks in two urban cities in France and the Netherlands. Researchers measured the RF-EMF from LTE (Long-Term Evolution) MC (macro cells meaning large cell towers) and SC networks (low-powered small cell base stations) and found that the small cell networks increased the radio emissions from base stations (called downlink) by a factor of 7–46 while decreasing the radio emissions from user equipment exposure (called) by a factor of 5–17. So while the devices themselves could emit less radiation, the cell antennas will increase the levels from cell antennas (Mazloun et al., 2019). This study shows the increased exposures would be involuntary. We can turn our phones off, but we cannot turn off the antennas in the neighborhood. <https://link.springer.com/article/10.1007%2Fs12243-018-0680-1>

From EH Trust to Everyone: 10:54 AM

An Australian study published in the Journal of Exposure Science & Environmental Epidemiology also found that children in kindergartens with nearby antenna installations had nearly three-and-a-half times higher RF exposures than children with installations further away by more than 300 meters (Bhatt et al., 2016). <https://www.ncbi.nlm.nih.gov/pubmed/27759027>

From Cece Doucette to Everyone: 10:57 AM

Rec. 12: Can we include other essential services? These have been well defined for COVID-19, and the public should be able to access those services too.

Senator Gray and others, the WHO determined RF is a Group 2B Possible Human Carcinogen in 2011. Now that the animal studies have been completed and show cancerous tumors and DNA damage, the WHO has re-opened its investigation in 2020: https://www.who.int/peh-emf/research/rf_ehc_page/en/index1.html

From EH Trust to Everyone: 10:58 AM

Research shows low level RF is tied to harm such as promoting tumors. And more

From Cece Doucette to Everyone: 10:58 AM

Please also note there are two WHO groups for EMFs, one is populated with those with industry ties, the other has independent scientists: <https://ehtrust.org/scientists-call-for-transparency-at-the-world-health-organization-emf-project/>

From EH Trust to Everyone: 11:00 AM

The science shows it IS substantiated

https://www.researchgate.net/publication/305689940_EUROPAEM_EMF_Guideline_2016_for_the_prevention_diagnosis_and_treatment_of_EMF-related_health_problems_and_illnesses

<https://www.sciencedirect.com/science/article/abs/pii/S0013935120303388?via%3Dihub>

Electromagnetic hypersensitivity (EHS, microwave syndrome) – Review of mechanisms
Peterborough, Canada

The City has an information sheet to help organizations accommodate individuals who have electromagnetic hypersensitivity. They recommend – among other things:

Temporarily disable City owned WAP devices.

Turn off or minimize fluorescent and LED.

Notify attendees to set mobile phones to airplane mode. <https://ehtrust.org/wp-content/uploads/EHS-Tip-Sheet-Peterborough-5-8-2018.pdf>

From Brandon.H.Garod to Everyone: 11:00 AM

I apologize but I have to leave for another meeting starting at 11:00

From Deb Hodgdon to Everyone: 11:00 AM

my oral surgeon was very happy to move me to a low rf room and make sure no one had devices in the room.

From EH Trust to Everyone: 11:03 AM

International

France: 13 Plaintiffs Win: The Tribunal de Grand Instance of Bordeaux ordered in favor of 13 of the 206 plaintiffs who had initiated a lawsuit against the installation of the electric meter created by Enedis.

<https://www.femmeactuelle.fr/sante/news-sante/compteur-linky-la-justice-donne-raison-a-13-plaignants-electrosensibles-2077743>

The word “unsubstantiated” should not be used.

Plus The WHO site being referenced is industry loyal and that is well documented in published research

<https://www.spandidos-publications.com/10.3892/ijo.2017.4046>

Actually it IS recognized and has been in several ada cases

From Jen White to Everyone: 11:03 AM

Both myself and 10 year old son are RF sensitive. It's very real and not to be discredited. Thank you. - Thank you Tom for saying that, much appreciated!

From EH Trust to Everyone: 11:04 AM

Austrian Medical Association

The Austrian Medical Association has developed a guideline for differential diagnosis and treatment of health problems associated with outdoor and indoor electrosmog.

Guidelines of the Austrian Medical Association for the diagnosis and treatment of EMF related health problems and illnesses (EMF syndrome) <https://ehtrust.org/wp-content/uploads/The-Austrian-Medical-Association-Guidelines-for-Diagnosis-and-Treatment-of-EMF-related-Health-Problems.pdf>

Exposure to Nonionizing Radiation ICD 10 Medical Codes for Exposure to nonionizing radiation – ICD-10-CM W90

“The ICD-10 code is the standard diagnostic tool for epidemiology, health management & clinical purposes. It is used for medical code lookups by physicians, nurses, researchers, health information managers, medical billing coders, health information technology workers, insurers & patient organizations to classify diseases and other health problems recorded on many types of health records, including death certificates. ICD 10 codes are also used by medical billers & payers for reimbursement purposes.”

Medicare Accepted ICD-10 codes under W90 for Exposure to other nonionizing radiation. These codes can be used for all HIPAA-covered transactions.

From Cece Doucette to Everyone: 11:04 AM

The public is welcome to join health care practitioners for the continuing medical education-accredited EMF Medical Conference in January where you will learn the science. We do have the studies already to prove wireless is harmful: <https://emfconference2021.com/>

From EH Trust to Everyone: 11:05 AM

2014:US Resident Provided Accommodations in Housing Case Regarding "Smart" Water Meters: Mechanical Meter For Resident PLUS Neighbors

Not only was a resident provided a mechanical meter after filing in court and coming to an agreement with the water authority; but in addition the neighbors of three adjacent properties also were provided free opt outs for the switch to mechanical meters.

That is correct- this switch AWAY from water meters was made with NO charges- NO FEES. The legal filing says that the Fair Housing Act prohibits discrimination based on disability.

Click here to see redacted HUD water meter agreement. <https://ehtrust.org/wp-content/uploads/HUD-meter-settlement-Redacted.pdf>

2014; Los Angeles Unified School District Accommodated a Teacher Who Fell Ill After Wireless Installation.

On September 18, 2014, LAUSD, the second largest public school district in the US, officially accommodated teacher Ms. Anura Lawson by approving her request to have the Wi-Fi turned off in her classroom during the 2014-2015 school year and alternatively approving a reassignment to a different school site where Wi-Fi has yet to be installed.

Watch the video of her testimony to the LAUSD School District Here. Read her letter of accommodation here. <https://ehtrust.org/wp-content/uploads/LA-Teacher-Accommodation.pdf>

From EH Trust to Everyone: 11:06 AM

We, physicians, acting in accordance with the Hippocratic Oath, we, scientists, acting in the name of scientific truth, we all, medical doctors and researchers working in different countries worldwide, hereby state in full independence of judgment,

that a high and growing number of persons are suffering from EHS and MCS worldwide; that EHS and MCS affect women, men and children;

that on the basis of the presently available peer-reviewed scientific evidence of adverse health effects of electromagnetic fields (EMFs) and various chemicals, and on the basis of clinical and biological investigations of patients, EHS is associated with exposure to EMFs and MCS with chemical exposure..."

Excerpt from the 2015 Brussels International Scientific Declaration on Electromagnetic Hypersensitivity and Multiple Chemical Sensitivity. Download http://www.ehs-mcs.org/fichiers/1441982143_Statement_EN_DEFINITIF.pdf

Magda Havas PhD at the National Institute of Environmental Health Sciences

"Electrosmog, the missing link as it relates to cancer, reproductive problems and electrohypersensitivity." https://www.youtube.com/watch?v=fqMCjEs9oxE&feature=emb_logo

From EH Trust to Everyone: 11:09 AM

The Who EMF project was started by industry funded scientist.

See EHT and others letter to The WHO EMF Project . They refuse to answer our letter and we have asked numerous times about that factsheet on The Who site . <https://ehtrust.org/scientists-call-for-transparency-at-the-world-health-organization-emf-project/>

There is no 50 times safety margin. This is a false statement because research on FCC record shows it. Read it here <https://ecfsapi.fcc.gov/file/7520958286.pdf>

From Cece Doucette to Everyone: 11:09 AM

The FCC limits are only based on heat exposure. The peer-reviewed non-industry funded independent science shows there is significant harm at the non-thermal level. Please see the Bioinitiative Color Charts for a summary of the science and findings of biological effects: <https://bioinitiative.org/rf-color-charts/>

From EH Trust to Everyone: 11:11 AM

The 50 times margin was based on a study of rodents with a thermometer in their rectum and it has been well disproved by science. Plus it is only about heating effects so it has nothing to do with cancer. <https://ecfsapi.fcc.gov/file/7520958286.pdf>

In fact for carcinogens the safety limit can be up to 10,000 times the level that cancer was found So even if there was a 50 times safety margin- it is not adequate protection.

From Cece Doucette to Everyone: 11:11 AM

Rec. 10: Can we expand this to bring hard-wired to residential premises too?

From Jen White to Everyone: 11:14 AM

<https://www.emfanalysis.com/fiber-optics-increasing-electrical-sensitivity/> - Will low EMI fiber optics be explored or discussed at some point?

From Cece Doucette to Everyone: 11:15 AM

Reliability is a factor too, in emergencies from storms, fires, etc., cell antennas often go down which leaves the public vulnerable to not being able to call for emergency services.

From Jen White to Everyone: 11:17 AM

We have a wired internet system that is not fiber optic. This is preferred and residents should have a choice, especially RF sensitive people such as myself.

From EH Trust to Everyone: 11:20 AM

There are no protections at the federal level to stop companies from using fiber for wireless purposes. Remember that if fiber optic is laid on a road, then a company can use it for their small cell. There should be federal protections in place to stop this.

Wireless companies like fiber because then they can attach wireless antennas. It should be wired to and through the premises. Please see this study on how to hardwire in buildings <https://www.sciencedirect.com/science/article/pii/S0360132319305347>

From EH Trust to Everyone: 11:31 AM

Please read about how wired technology uses more energy consumption compared to wireless. <https://ehtrust.org/science/reports-on-power-consumption-and-increasing-energy-use-of-wireless-systems-and-digital-ecosystem/>

The California Association of Realtors' Property Sellers Questionnaire specifically "cell towers" listed on the disclosure form for sellers of real estate. The seller must note "neighborhood noise, nuisance or other problems from.." and includes cell towers and high voltage transmission lines on the long list problems. Click here to see the California Association of Realtors' Property Sellers Questionnaire (p. 3-4 under K. Neighborhood) <https://ehtrust.org/wp-content/uploads/Real-Estate-Seller-Property-Questionnaire-reduced-12-17-1.pdf>

From Paul Bloede to Everyone: 11:32 AM

I show a vote was taken on both 8 and on 8A, at the 9/22 meeting. Both were approved, with slightly different tallies. 8 was voted in with 7 yes, 1 no, and 5 abstain.

From EH Trust to Everyone: 11:33 AM

2014 Survey by the National Institute for Science, Law and Public Policy (NISLAPP) in Washington, D.C., "Neighborhood Cell Towers & Antennas—Do They Impact a Property's Desirability?" Home buyers and renters are less interested in properties located near cell towers and antennas, as well as in properties where a cell tower or group of antennas are placed on top of or attached to a building. 94% said a nearby cell tower or group of antennas would negatively impact interest in a property or the price they would be willing to pay for it.

Read the Press Release: Survey by the National Institute for Science, Law & Public Policy <https://electromagnetichealth.org/electromagnetic-health-blog/survey-property-desirability/>

Best Best and Krieger Letter to Ms. Marlene H. Dortch, Secretary Federal Communications Commission September 19, 2018 "RE" Smart Communities and Special Districts Coalition – Ex Parte Submission: Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment, WT Docket No. 17-79; Accelerating Wireline Broadband Deployment by Removing Barriers to Infrastructure Investment, WC Docket No. 17-84" "A good example lies in the Commission's discussion of undergrounding.⁶² The Commission at once appears to recognize that communities spend millions of dollars on undergrounding projects, and that allowing poles to go up in areas where poles have been take down has significant impacts on aesthetics (not to mention property values)."

From EH Trust to Everyone: 11:34 AM

[https://www.montgomerycountymd.gov/cable/Resources/Files/Towers/cellTowerInfo/Ex%20Parte-Smart%20Communities%20and%20Special%20Districst%2009-19-18-c2%20\(1\).pdf](https://www.montgomerycountymd.gov/cable/Resources/Files/Towers/cellTowerInfo/Ex%20Parte-Smart%20Communities%20and%20Special%20Districst%2009-19-18-c2%20(1).pdf)

“Appraiser: Cell Tower Will Affect Property Values” New Jersey Patch on T Mobile Cell Tower
“Properties that are approximately close to the tower will suffer substantial degradation to their value based on the nature of the unusual feature in the residential neighborhood.” <https://patch.com/new-jersey/bridgewater/appraiser-t-mobile-cell-tower-will-affect-property-values>

From Deb Hodgdon to Everyone: 11:34 AM

I know a home inspector who is very interested in being trained and licensed to do that

From EH Trust to Everyone: 11:37 AM

ConsumerWatch: 5G Cellphone Towers Signal Renewed Concerns Over Impacts on Health
In this news report below- California investigative reporter Julie Watts interviews firefighters and California officials on the SB649 exemption for firefighters. It is very clear this is about health effects as the firefighters state it

From Deb Hodgdon to Everyone: 11:37 AM

sounds like it interferes because you can't think quickly and efficiently

From EH Trust to Everyone: 11:39 AM

Read it here <https://sanfrancisco.cbslocal.com/2018/01/25/consumerwatch-5g-cellphone-towers-signal-renewed-concerns-over-impacts-on-health/>

you can simply say that the firefighters lobbied because of health effects

Which is documented in numerous documents

The CBS story say So, following lobbying by firefighters, assemblyman Quirk and his co-author exempted fire stations from their bill, making them one place cell companies couldn't put a tower."

read it here <https://sanfrancisco.cbslocal.com/2018/01/25/consumerwatch-5g-cellphone-towers-signal-renewed-concerns-over-impacts-on-health/>

you could quote the CNS report <https://sanfrancisco.cbslocal.com/2018/01/25/consumerwatch-5g-cellphone-towers-signal-renewed-concerns-over-impacts-on-health/>

From Cece Doucette to Everyone: 11:39 AM

Rec 7: There is a private property owner in Pittsfield, MA who just opted for a cell tower on the edge of the property, which abuts a neighborhood of eight streets. Only three of the proposed 46 antennas have been turned on, and children and adults are already experiencing headaches, insomnia, cognitive impairment, and one little girl described it as, "Mommy, I feel all buzzy inside." The public needs to be protected from all cell antennas regardless of whose property they are on. The epidemiological studies

show similar biological effects within 1,500 or so feet from a cell antenna:

<https://sites.google.com/site/understandingemfs/cell-towers>

From Deb Hodgdon to Everyone: 11:40 AM

yes pat.

From EH Trust to Everyone: 11:42 AM

““This is the first piece of legislation that anyone is aware of where somebody got an exemption because they were concerned about health. Did they tell you at all about the study?” we asked the assemblyman.

Quirk’s response: “All I know is that when the firefighters ask, I do what they ask me to do.”

<https://sanfrancisco.cbslocal.com/2018/01/25/consumerwatch-5g-cellphone-towers-signal-renewed-concerns-over-impacts-on-health/>

This is a study- although a few years old- details why restricting cell towers from schools is a human rights issue https://ecfsapi.fcc.gov/file/1070795887708/Roda%26Perry_EnvSci%26Policy_.pdf

From EH Trust to Everyone: 11:54 AM

The FCC is not actively taking measurements.

In fact a Wall Street Journal shows many sites exceed FCC limits

<https://www.wsj.com/articles/cellphone-boom-spurs-antenna-safety-worries-1412293055> One in 10 sites violates the rules, according to six engineers who examined more than 5,000 sites during safety audits for carriers and local municipalities, underscoring a safety lapse in the network that makes cellphones hum, at a time when the health effects of antennas are being debated world-wide.

No, the FDA does not say anything about bees and trees

From Cece Doucette to Everyone: 11:54 AM

6A: Minor typo on the bold line, "...be empowered is to be immediately..." remove the words "is" and "be".

From EH Trust to Everyone: 11:59 AM

If you go to the website by the FDA

you will see that in fact they have not looked at all the data

The FDA did not look at impacts to sperm or impacts to brain damage. That is all on the record

<https://ehtrust.org/scientistsletter-calling-for-a-retraction-to-the-fda-report-on-cell-phone-radiation-and-cancer/>

From Jen White to Everyone: 11:59 AM

If 5G moves forward in NH, Will there be any RF "safe zones" in residential areas where RF sensitive residents live? If we have a 5G repeater outside of our home.....that is literally a sick sentence for my 10 year old son!

From EH Trust to Everyone: 12:03 PM

For the record <https://www.sciencedirect.com/science/article/pii/S2542519618302213?via%3Dihub>
Ronald N. Kostoff, Paul Heroux, Michael Aschner, Aristides Tsatsakis, Adverse health effects of 5G mobile networking technology under real-life conditions, Toxicology Letters, Volume 323, 2020, Pages 35-40, <https://www.sciencedirect.com/science/article/abs/pii/S037842742030028X>

Thermal and non-thermal health effects of low intensity non-ionizing radiation: An international perspective, Environmental Pollution, Volume 242, Part A, 2018, Pages 643-658, ISSN 0269-7491, <https://doi.org/10.1016/j.envpol.2018.07.019> . <https://www.ncbi.nlm.nih.gov/pubmed/30025338>

**NH COMMISSION TO STUDY THE ENVIRONMENTAL AND HEALTH EFFECTS
OF EVOLVING 5G TECHNOLOGY**

Meeting held:

10/27/20

1:00 -1:47pm EST

Via Zoom (<https://unh.zoom.us/j/8760768986>)

Via telephone-US (1 312 626 6799 (US Toll) ID: 876 076 8986)

In attendance: (13)

Rep. Patrick Abrami-speaker of the house appointee

Rep. Ken Wells- speaker of the house appointee

Kent Chamberlin, Phd.-UNH-appointed by the chancellor

Denise Ricciardi-public-appointed by the governor

Michele Roberge-DHHS- Commissioner of DHHS appointee

Paul Heroux,Phd.- Professor of Toxicology, McGill University- speaker of the house appointee

Rep. Gary Woods-speaker of the house appointee

Senator Jim Gray-president of the senate appointee

Senator Tom Sherman-president of the senate appointee

Brandon Garod,Esq.-AG designee, Asst. AG Consumer Protection

Bethanne Cooley-CTIA , trade association for wireless industry and manufacturers

Carol Miller-NH Business & Economic Affairs Dept.

David Juvet-Business and Industry Association

Not present: (0)

Meeting called to order by Rep Abrami at 1:03 am

Abrami: Due to the Covid 19 virus and the Executive order signed by the Governor this public meeting is allowed to be conducted via Zoom. It is open to the public for viewing and was duly posted as a zoom meeting. With that said, if you are not a member of the Commission, can you please turn your cameras off and mute yourselves? That would be much appreciated. In addition the meeting is being recorded as an aid to doing the minutes. All chat room discussions will be included in the minutes.

I. Approval of minutes from 10-8-20

Let's start with the minutes from the October 8th meeting. I have not received any changes to the minutes that I sent out about a week ago. Are there any changes that anyone wants to make? Seeing none, I will say ...without objection, we approve the minutes from that meeting.

II: Agreed to Recommendation changes

Sherman: Pat, I think you need to do the “right to know” script and a call of the roll, don’t you? Maybe it’s different for the House than the Senate.

Abrami: I am doing it with what I just read. The last meeting we voted on many of the recommendations in the report and I want to go through to show you. Kent, can you pull up Page 9? I am not going to be able to see you all as Kent will be sharing his screen. So members just jump in if you have something to say.

Fourth line from the bottom, “principle” was spelled incorrectly and was corrected.

Recommendation #1 is the old 1. We agreed after the bold where you see Telecommunication Act, to delete “TTA”.

Recommendation #2 is the old 3. We changed “attachment” to “appendix”. “There is” in the last line was taken out as it made no sense.

Recommendation #3 is the old 4. The word “harm” was taken out three lines from the bottom as that made no sense.

Recommendation #4 is the #5, the next to the last paragraph: five lines up: is required for “data”.

Recommendation #5 is the old 6A. In the bold where it says, the municipality is... “to be” was deleted. “in “ was changed to “to”.

Recommendation 6 is the old 6B: should show “as having” instead of “to have” significant impact. Joel, please change that.

Recommendation 7 is the old 7. The “of” was inserted between right and property.

Recommendation 8 is the old 8.

Recommendation 9 is the old 8A.

Recommendation 10 is the old 9. “detailed” replaced detail.

Recommendation 11 is the old 10,

Recommendation 12 is the old 11,

Recommendation 13 is the old 12.

Recommendation 14 is the old 13.

Recommendation 15 is the old 14.

Those are the changes. Does anybody recall anything differently about any of these changes?

III: Report walk through

Abrami: Kent, can you put the report back up? On this first page, Beth contacted me. We have Beth as representing cell phone/wireless technology industry. We are going to put CTIA, representing the wireless industry. Is that okay with you Beth?

Cooley: That's fine. Thank you.

Abrami: The next page is the disclaimer that all three agencies were okay with.

Miller: Before we move on, my title is incorrect as well. I am not representing the High Tech Council. That no longer exists. It's the Tech Alliance but I am not representing them either. I am from the New Hampshire Dept. of Business and Economic Affairs.

Abrami: Any others on title changes? Ok. Next we have the Table of Contents. We have a bit of introductory discussion then a summary of observations and the recommendations that we went over. We have chosen to insert the Minority Report in the report. We will get to the Minority Report in a while. Then we have the Appendices and the Minutes, which are extensive. They are basically a total recording of what happened in our meetings. As far as the introduction, I talk about the Commission responsibilities and my view that it's an evolving role as we learned about the different technologies and how 5G works with 4G and 3G. Our discussions evolved over time. Basically, it became all things RF radiation. We talked about the various meetings that we had and who the main presenters were and our big hiatus for four months. Then we have Questions posed by HB522. Then we have a section on Summary and Observations. We actually got the reference to the 800,000 small cell towers from the CTIA website.

IV: Discussion

Abrami: Any discussion?

Sherman: Pat, I just want to thank people both on the Majority and the Minority side for all the work they put in. I think everybody in spite of their differences of opinion or their different interpretations of the science. I think everybody has approached this with incredible fairness and collegiality. Thank you for leading it and for all the work that everybody has done.

Abrami: I was going to say when we got to the Minority Report, Jim I think you did a great job on it. To me, it makes the report even better having both sides represented in the report. The majority of the members yielded to the precautionary principle because there are still a lot of unanswered questions. Is there any other discussion?

V: Report Vote

Let's vote on the majority report: Yes, No or Abstain.

Sherman: yes

Wells: yes

Chamberlin: yes

Miller: abstain

Ricciardi: yes

Juvet: no

Cooley: no

Garod: abstain

Roberge: abstain

Heroux: yes

Woods: yes

Gray: no

Abrami: yes

7-yes, 3-no, 3-abstain. This will be considered the Majority Report.

VI. Minority Report:

Abramj: Jim, we have to have a lead in. For example, Jim Gray and the others who want to sign on have to let us know who they are. Jim do you want to go through this?

Gray: I am not going to go through a lot. One of the reasons that we got the report to you twenty four hours before this meeting is so that you could look at it. It's the same things that I have been talking about in the various meetings. The FCC and the FDA have on their websites a plethora of information about the safety of 5G and 4G and 3G as they are used for the cell phone industry. The first page starts off as a quick summary about the 50x safety factor that's in there and the rest. There are a lot of references in there because we were trying to say that we are not making these things up. There is stuff that is available on the FCC and the FDA websites. I can't remember if we left the WHO in there or not at the end. Things tend to get a little confused right now with campaigning and everything else. You have had a little time to review it. If anyone has questions, they can forward them to me. What I would do

rather than having anyone on this zoom meeting say they support or don't support. It would certainly be fine with me if someone wanted to notify you as the chair at some other point. I think I will leave it at that.

Abrami: Any questions for Jim?

Juvet: no questions, Mr. Chair. I think you said those who want to sign onto the Minority Report that they need to let you know. I wish to be signed on to the Minority Report.

Cooley: As would CTIA as well.

Abrami: Ok. Fine. So you don't have objection at the beginning to say the three of you are the Minority members? Is that ok?

Gray: either at the beginning or at the end.

Abrami: I am going to yield to Joel.

Anderson: I think it is just as well to put it at the beginning. People will know upfront who the Minority Report is from.

Gray: It can be as simple as, the undersigned not being able to agree with the majority, offer the following report and then list the three names. Does that work for everyone?

Abrami: yes.

Anderson: Can it be instead that you endorse the report? Because you won't actually be signing it.

Abrami: House Commissions don't require signatures.

Juvet: Whatever the appropriate wording is, I am good with.

Abrami: Joel, after we do it, we can share it with the three Minority members.

Ricciardi: is it acceptable to read my comments?

Abrami: yes. It's appropriate.

Ricciardi: I genuinely appreciate everybody's point of view.

First, on foot note two, it addresses only thermal effects but if you see appendix D of the Majority Report there is science showing harmful effects at the non-thermal level. I just wanted to draw attention to that. In the Minority Report, it cites the IEEE papers but the IEEE does not have medical or biological expertise. However even the IEEE has acknowledged harm at the non-thermal level in two papers which I have sent to you. In 2016 IEEE acknowledged biological effects of non-ionizing microwaves in the IEEE Power and Electronics magazine article. I wanted to also mention that the Minority Report makes several references to the American Cancer Society but fails to provide links to the sources. Furthermore, the American Cancer Society in 2016 called the NTP study a paradigm shifting of good science. The

public should also note that the American Cancer Society reports a sharp rise in colon and rectal cancer among young adults at the very locations where many carry their cell phones. In footnotes 11 and 12, the World Health Organization citations are out of date. In 2020, the WHO reopened its investigation into the biological effects. Additionally, there are two groups at the WHO that report on EMFs. One is represented by the industry. The other is represented by independent scientists with credentials appropriate to weigh in on the biological effects. In footnotes 18 and 19, the Minority Report indicated the rate of brain tumors in humans as being flat for the last twenty years. This is not true. Cancer registries are typically five years behind and while overall cancer cases are not rising as they once did. The following show dramatic growth where cell phones and wireless devices are used or stored on the body or cell tower emissions. The incidence of glioblastoma is the deadliest type of brain tumor and I have links to all of this that I have mentioned which I am going to forward to you. The last thing I want to say is that industry tends to focus on the cancer rates as cancer takes the longest time to develop during which time the industry can continue to promote toxic products. Other diseases are developing more rapidly as shown in the Majority Report, in Appendix D, including infertility, neurological harm and especially to children. With regard to the section on 5G mm waves, the IEEE is referenced yet again. These are industry engineers who do not have the biological expertise. I just wanted that for the record.

Abrami: Ok. It will be in the minutes.

Heroux: Essentially, one thing I regret is I am addressing primarily the people of the Minority Report, is that there was not more discussion between us. What I mean by this is technical discussion in looking at the actual issues. I know that probably most of the people of the Minority Report felt very solid in their opinions relying on legislation that was passed and I can understand that. In spite of our differences, I do respect your opinion because this is your opinion. One last comment is that we were not provided the material that would have led to this discussion. Perhaps the people who were in the Majority Report could assemble more energy to present. In fact, the same amount of enthusiasm was not apparent on the other side. I would like to remind the Commission that on January 10th meeting, there were promises by the CTIA to provide us with reports that support the positive health impacts of cellphone deployment. These reports did not materialize. Essentially, I think that the lopsidedness that is quoted in the Minority Report is more a result of energy and initiative in providing evidence. Thank you.

Abrami: Ok. Any other comments at this point?

VII: Minutes of this Meeting:

Abrami: Let's talk about the minutes of this meeting. They will be in the report. Deb Hodgdon is going to work very hard and we will get the minutes out to everybody. We will not have a meeting to approve them. If you see something you think is incorrect, please email me. We want to get this report in by November 1st with the minutes of this meeting included. Is that okay with everybody? Ok. Thank you.

VIII: Submission Process

Abrami: I talked to Jim about this. I think he is okay with us putting the Minority Report in the same style type as the rest of the report. There will be a letter of transmittal. The report goes to the Governor, the Speaker and the Senate President. There is a letter of transmittal that the House staff will put together. There are no signatures on it just the letter of transmittal that goes on top of the report and it's sent out. This report will be posted online on the Commission's website. We added that website to the report so if anybody wanted to see the additional information or papers we posted there, things like that will be available for the public. It's all about the minutes. No pressure Deb. If I stop talking, we can get the minutes done sooner right?

IX. Commission Farewells

Abrami: First I want to say, it's been a pleasure working with all of you. We had a great group. There were a lot of scientific minds in the room, legal, business. We didn't agree on everything as Tom said but I think we all got along very well. I want to specifically point out Kent Chamberlin for coming to the rescue. When we couldn't get bandwidth from the state to continue this Commission, he volunteered. Or I asked him to volunteer! UNH's zoom capacity was great as well as setting up all those meetings and being behind the scenes making the meetings go smoothly.

I want to thank Joel Anderson for his support behind the scenes. It was a lot of work especially when it came to the report and I think I hinted at this when I sent something out. There was one night he worked until ten o'clock at night to get the report ironed out. He proofed a lot of the report and found links that were outdated or not working and corrected those. Thank you, Joel for going beyond the call of duty.

And of course I want to point out Deb Hodgdon who has been doing our minutes since the beginning. These minutes are more like a court transcription. I know she spends a lot of time going through and preparing those.

I also want to thank the audience. I know we never formally opened it to the public which I had promised. That has to do with the fact that we closed down for four months. We missed five meetings. We were just cramped for time or we would have opened this up more to the public. But with zoom, we were able to open it up to more than just ten or so people that would gather at the onsite meetings at the statehouse. We have people from all over participating. Their comments in the zoom chat were captured and added to the minutes.

I thank you all again. Does anybody want to make any closing comments?

Ricciardi: I just want to say that it was an honor to work with all of you. It really was and I am so proud of the work that we have all done. So, thank you.

Heroux: To me, this commission is extremely memorable. I would like to congratulate the Chair on bringing this difficult boat to port. I want to ensure all of you, especially those of the Minority Report

that you can contact me at any point in the future and you will have my full cooperation if you need my help. Thank you.

Cooley: Will we be notified when the letter of transmittal is sent? Will the Commission know?

Abrami: We will make sure everyone gets notified. It will be out there electronically and we will let you know where to go to find it.

Cooley: Thank you.

Abrami: Stay well. We are formally adjourned (1:47 pm)

Chat from HB522 5G Commission Meeting, October 27, 2020

From Beth Cooley to Me: (Privately) 01:23 PM

Should Herman's video be shown? just curious. I've directed my members to turn their videos off

From Theodora Scarato to Everyone: 01:27 PM

The World Health Organization EMF Project The World Health Organization EMF Project says "There is no consensus."

Dr. Emilie van Deventer, Head of the World Health Organization's EMF Project was quoted in The Daily Princetonian, "The data is gray. It's not black and white...There is no consensus, it's true."

"Furthermore, as I see it, the WHO EMF Project was not only hijacked by the ICNIRP but, from the inception, it was set up as a front for the ICNIRP agenda of unifying exposure standards to RF-EMF," stated Dariuz Leszczynski PHD (a member of the EMF working group of the WHO/IARC who stated in 2020," ICNIRP is a private club. Its new members are selected by the current members where the prerequisite of selection is the very close similarity of opinions on non-ionizing radiation health effects. There are no published criteria for the selection of new members. Nobody checks whether the selected experts are sufficiently good experts."

<https://betweenrockandhardplace.wordpress.com/2020/09/08/leszczynski-there-is-something-utterly-wrong-with-the-icnirp-membership/>

From Theodora Scarato to Everyone: 01:27 PM

Fact: There is no 50 times safety margin. The FCC is ignoring the science and promoting the myth of the 50 times safety factor despite being informed that it is not based on scientific fact.

Scientific data refutes the claim. The FCC says this factor is based on studies that show behavioral disruptions to animals at 4 w/kg. However the EPA found thermal harm at 1 W/kg. The EPA stated in 2020 that the last time the agency did a research review was in 1984 as detailed in the 1984 EPA Report The Biological Effects of Electromagnetic Fields. The EPA 1984 Report concludes with the summary that

“It has been concluded from this review that biological effects occur at SAR up to about 1 W/kg some of them may be significant under certain environmental conditions.” Therefore the level of harm of 4W/kg used by IEEE and adopted by FCC is inaccurate. See the 1984 EPA report, Comments of Pong Research Corporation, Environmental Working Group and Environmental Health Trust.

<https://ehtrust.org/epa-1984-report-biological-effects-of-emfs/>

From Theodora Scarato to Everyone: 01:28 PM

Furthermore, the Environmental Protection Agency typically uses safety factors in the 100s or 1000s range for noncancer endpoints and for carcinogens, a threshold or nonthreshold approach is used (National Research Council (US) Committee on Improving Risk Analysis Approaches Used by the U.S. EPA).

<https://www.ncbi.nlm.nih.gov/books/NBK214619/>

Of key importance, even if there were a slim safety factor, the level chosen is about heating harm only. It is thermally based and has nothing to do with biological harm from non thermal exposures that can occur at far far lower RF exposures.

Furthermore these limits were not based on protecting trees, birds, insects or the natural environment. Thus, flora and fauna are entirely unprotected.

The EPA 1984 Report concludes with the summary that “It has been concluded from this review that biological effects occur at SAR up to about 1 W/kg some of them may be significant under certain environmental conditions.” Therefore the level of harm of 4W/kg used by IEEE and adopted by FCC is inaccurate.

From Theodora Scarato to Everyone: 01:30 PM

There is no 50 times safety factor as a fact of science. The FCC is ignoring this science - ignoring the EPA Ignoring facts

Despite the fact that the WHO EMF Project website seems to imply the research shows no harm, such statements are unsubstantiated and are based on a house of cards. The fact is the WHO EMF Project has yet to do a full evaluation of the recent research and the last monograph was in 1993. This is stated on their website quite clearly “The World Health Organization is undertaking a health risk assessment of radiofrequency electromagnetic fields, to be published as a monograph in the Environmental Health Criteria Series. This publication will..update the monograph on radiofrequency fields (1993).”

https://www.who.int/peh-emf/research/rf_ehc_page/en/

Do not confuse the World Health Organization EMF Project with the The World Health Organization International Agency for the Research on Cancer.

These are two separate entities. Unlike the WHO EMF Project (started by a scientist found to be funneling industry money though a university), the WHO International Agency for Research on Cancer (WHO/IARC) which is vetted for conflicts of interest and for whom scientists cannot be financially connected to Telecom.

From Theodora Scarato to Everyone: 01:34 PM

In 2011, the WHO/IARC classified RF as a Class 2 B “possible” human carcinogen based primarily on evidence from human studies that long-term users of mobile phones held to the head resulted in an elevated risk of developing brain cancer. One major reason that the IARC rating was not at “probable” or “known” was the lack of clear evidence from animal studies for exposure leading to cancer.

https://www.iarc.fr/wp-content/uploads/2018/07/pr208_E.pdf

In 2019, the advisory group of the International Agency for Research on Cancer (IARC) of the World Health Organization released new recommendations to reassess as a “high priority” the cancer risks of radiofrequency (RF) radiation between 2020–2024. The recommendations were published in The Lancet Oncology on April 18, 2019.

[https://www.thelancet.com/journals/lanonc/article/PIIS1470-2045\(19\)30246-3/fulltext](https://www.thelancet.com/journals/lanonc/article/PIIS1470-2045(19)30246-3/fulltext)

CDC shows tumors increasing in children. Read it here <https://ehtrust.org/cdc-finds-brain-liver-and-thyroid-cancers-increasing-among-us-children-2001-2014/>

From Theodora Scarato to Everyone: 01:35 PM

http://aspho.org/uploads/meetings/2018annualmeeting/Abstracts_for_Website.pdf

Centers for Disease Control and Prevention, Atlanta, Georgia, United States

link: http://aspho.org/uploads/meetings/2018annualmeeting/Abstracts_for_Website.pdf

“increased for non-Hodgkin lymphomas (except Burkitt lymphoma), central nervous system neoplasms, renal tumors , hepatic tumors , and thyroid carcinomas...”

http://aspho.org/uploads/meetings/2018annualmeeting/Abstracts_for_Website.pdf

From EHT- Recently a reporter told EHT that this data seemed to be in contradiction to information posted on the National Cancer Institute (NCI) website. The reporter asked how EHT could be stating that CDC says brain cancers are rising in pediatrics when the reporter went online and found information stating “the brain cancer rates were stable.” He sent this link.

So we wrote the CDC scientist and the CDC scientist responded to EHT that that the NCI link sent by the reporter refers to statistics that represent only 13.4% of the US population, whereas the new CDC report uses the USCS database representing 98% of the US population.

From Theodora Scarato to Everyone: 01:37 PM

The European Scientific Committee on Health, Environmental, and Emerging Risks’ “Potential effects on wildlife of increases in electromagnetic radiation statement identified emerging issues (including 5G, E-cigarette, and chronic diseases.) The Committee prioritized 5G impact as “high” noting the lack of adequate research and citing studies documenting harmful effects such as Pall 2018, Di Ciaula 2018 and Russell 2018. The report concluded “the lack of clear evidence to inform the development of exposure guidelines to 5G technology leaves open the possibility of unintended biological consequences.”

https://ec.europa.eu/health/sites/health/files/scientific_committees/scheer/docs/scheer_s_002.pdf

The 2020 Executive Summary of the Health Council of the Netherlands said clearly that there is no information on mm-waves and human health:“...There has been almost no research into the effects of exposure to frequencies around 26 GHz...”And they recommended against using higher frequencies stating “...The committee recommends not using the 26 GHz frequency band for 5G for as long as the potential health risks have not been investigated...”

From Theodora Scarato to Everyone: 01:37 PM

<https://www.healthcouncil.nl/documents/advisory-reports/2020/09/02/5g-and-health>

From Cece Doucette to Everyone: 01:39 PM

When will the report be posted?

From Theodora Scarato to Everyone: 01:39 PM

Numerous governments also educate their citizens with recommendations to reduce cell phone radiation, especially to the heads of children. Governments with policy and/or recommendations by health authorities include Belgium, Switzerland, French Polynesia, Finland, Ireland, Germany, Greece, Israel, Turkey, Singapore, France, United Kingdom, Russia, Denmark, India, Australia, Austria, Cyprus, Canada, Italy, Korea and Croatia. In 2011 the Parliamentary Assembly of the Council of Europe issued Resolution 1815: "The Potential Dangers of Electromagnetic Fields and Their Effect on the Environment." A call to European governments to "take all reasonable measures" to reduce exposure to electromagnetic fields "particularly the exposure to children and young people who seem to be most at risk from head tumours" and numerous municipalities have issued resolutions to follow Resolution 1815. <https://ehtrust.org/policy/international-policy-actions-on-wireless/>

From Cece Doucette to Everyone: 01:43 PM

Sincere gratitude to all for your dedication in seeking the truth and laying the path to transition to safe, sustainable, fiscally responsible technology.

From Theodora Scarato to Everyone: 01:44 PM

Thanks beyond words for your incredible effort in putting forward scientific facts in a transparent fashion.

The Honorable Alex Azar
Secretary of Health and Human Services
U.S. Department of Health & Human Services
200 Independence Avenue, S.W.
Washington, D.C. 20201

The Honorable Stephen Hahn MD
Commissioner of Food and Drugs Administration

Jeffrey Shuren, M.D., J.D.
Director, Center for Devices and Radiological Health

Food and Drug Administration
10903 New Hampshire Avenue
Silver Spring, MD 20857

Sent electronically to ombuds@oc.fda.gov, DICE@fda.hhs.gov, jeff.shuren@fda.hhs.gov,
Stephen.Hahn@fda.hhs.gov, Secretary@HHS.gov,

Re: FDA Literature Review on Cell Phones

Dear Honorable Commissioner Hahn, Honorable Secretary of Health and Human Services Alex Azar and
Dr. Shuren Director of the FDA Center for Devices and Radiological Health;

The selective FDA review is not in line with the majority of the scientific community on the issue of RF EMF health effects. I and more than 220 scientists from 41 countries, many of them EMF-active, have signed the International EMF Scientist Appeal (EMFscientist.org, 2015), which calls on the World Health Organization (WHO), the United Nations, and all member nations to issue health warnings about the risks of RF and ELF EMF exposure and to adopt much stronger exposure guidelines to protect humans than the outdated International Commission on Non-Ionizing Radiation Protection (ICNIRP) suggest. Please be aware that ICNIRP standards, while slightly different from the FCC standards, are also based on avoiding thermal RF effects for short periods of time -- acute (not chronic) exposures. In this regard, ICNIRP guidance ignores thousands of studies showing non-thermal RF effects.

Multiple studies (not referred to in the selectiveFDA review) have appeared since the classification of RF as possible human carcinogen, Group 2B, by the International Agency for

Research on Cancer (IARC) in 2011 (IARC, 2013). These studies from our laboratory and many others demonstrate carcinogenic potential of non-thermal RF exposures and preferential primary mechanism through induction of reactive oxygen species (ROS), see for review ([Belpomme, Hardell, Belyaev, Burgio, & Carpenter, 2018](#); [Belyaev, 2015a, 2015b, 2017, 2019](#); [Belyaev et al., 2016](#)).

The National Toxicology Program (NTP) findings along with recent replicated animal studies from Germany ([Lerchl et al., 2015](#)), supplemented other animal studies and provided sufficient evidence for carcinogenicity of cellphone exposure in animals. The NTP results on schwannoma and glioma are of special concern since they corroborate human epidemiology findings on human use of cell phones where similar tumors were found. Studies with chronic exposures have also provided evidence for possible mechanisms of RF non-thermal effects, which involve production of reactive oxygen/nitrogen species. According to the unanimous opinion of the 19-member peer review panel that examined NTP study ([NTP, 2018](#)), its results provide “clear evidence”—the highest standard of proof—that RF fields cause schwannomas (malignant tumors of the Schwann cells that sheath all myelinated nerves) in the hearts of male rats.

Taking into account the evidence from human epidemiological studies, I concur with a number of experts in the field that evidence at this time supports the classification of RF exposure from cell phones as human carcinogen according to the generally accepted Bradford Hill criteria ([Carlberg & Hardell, 2017](#); Miller et al., 2018). The NTP study also reported less clear evidence that RF causes various other tumors (gliomas in the brain, pheochromocytomas in the adrenal gland, and tumors of the prostate and pancreas) ([NTP, 2018](#)). In contrast to the selective FDA review, the IARC advisory group of 29 scientists from 18 countries has recently stated that the new bioassay and mechanistic evidence warrants high-priority re-evaluating the RF-induced carcinogenesis ([Marques et al., 2019](#)).

Based on these considerations, I urge the FDA to withdraw their selective report from publication, convene an independent expert group to evaluate all the evidence including mechanistical and in vitro studies, which were omitted by the FDA report, and take steps to advise the public on how to reduce exposures to radiation at this time.

Igor Belyaev, PhD, Dr.Sc.

Associate Professor

Head, Department of Radiobiology

Cancer Research Institute, Biomedical Research Center of the Slovak Academy of Science

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The Honorable Alex Azar
Secretary of Health and Human Services
U.S. Department of Health & Human Services
200 Independence Avenue, S.W.
Washington, D.C. 20201

The Honorable Stephen Hahn MD
Commissioner of Food and Drugs Administration

Jeffrey Shuren, M.D., J.D.
Director, Center for Devices and Radiological Health

Food and Drug Administration
10903 New Hampshire Avenue
Silver Spring, MD 20857

Sent electronically to ombuds@oc.fda.gov, DICE@fda.hhs.gov, jeff.shuren@fda.hhs.gov,
Stephen.Hahn@fda.hhs.gov, Secretary@HHS.gov,

Re: Call for Retraction of Flawed FDA Literature Review on Cell Phones

Dear Honorable Commissioner Hahn, Honorable Secretary of Health and Human Services Alex Azar and Dr. Shuren, Director of the FDA Center for Devices and Radiological Health;

As experts in the field of bioelectromagnetics, we are writing to urge you to retract a recent flawed report entitled "[Review of Published Literature between 2008 and 2018 of Relevance to Radiofrequency Radiation and Cancer](#)". Further, we ask you to remove and replace recent revisions to FDA websites that invoke this recent report as grounds for asserting that cellphone radiation has no known health effects, contrary to official reviews in other high-technology nations.

As many of us have detailed in letters sent to your offices, this report does not merit publication or posting on FDA's website as it represents a highly limited review of the literature, contains "numerous scientific errors" omitting important studies for review and including studies that have been rejected for their flawed methods, and fails to acknowledge official actions by governments in [France](#), [South Korea](#), [Belgium](#), [Cyprus](#), [European Parliament](#) and recommendations by the [American Academy of Pediatrics](#) and [California Department of Public Health](#) that have issued specific advice about why and how to reduce exposures to cellphones and other wireless radiation sources. By dismissing scientific evidence of adverse effects and downplaying the need for individuals to take precautionary measures when using cell phones, the FDA review does not comport with the Agency's mission of protecting and promoting public health.

Contrary to what the report and FDA website assert, there is no “scientific consensus” that cell phone radiation and 5G are safe as evidenced by the [official statements](#) of hundreds of scientists and medical organizations.

The FDA in collaboration with US health and environmental agencies should convene an interdisciplinary panel of independent experts to provide a systematic review of relevant literature on cell phones and wireless radiation and health to guide the agency in its policy recommendations. Further, any such review should also consider the growing evidence of environmental effects along with public health impacts of exposures as well as relevant policy developments.

Signed,

Ronald Melnick PhD, former National Institutes of Health Scientist

Lennart Hardell MD, PhD, Professor Department of Oncology, Faculty of Medicine and Health, Örebro University, SE-701 82 Örebro, Sweden (retired). The Environment and Cancer Research Foundation Örebro, Sweden

Samuel Miham MD, former Head of the Chronic Disease Epidemiology Section, Washington State Department of Health

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Henry Lai, PhD, Professor Emeritus, University of Washington, Seattle, WA

Alfonso Balmori, BSc Biologist. Spain

Beatrice Golomb, MD PhD, Professor of Medicine, University of California, San Diego

Devra Davis, PhD, MPH President of Environmental Health Trust and Fellow American College of Epidemiology, former founding Executive Director, Board on Environmental Studies and Toxicology, National Academies of Sciences, Engineering and Medicine

Hillel Baldwin, MD, Fellow American Association of Neurological Surgeons

Dr. Anthony Miller, Professor Emeritus of University of Toronto and World Health Organization Senior Advisor to Environmental Health Trust

Prof. Tom Butler, University College, Cork, Ireland

Igor Belyaev, PhD, Dr.Sc.Head, Department of Radiobiology of the Cancer Research Institute, Biomedical Research Center of the Slovak Academy of Sciences

Magda Havas, Ph.D., Associate Professor, Trent University

Prof. Suleyman Dasdag, Department of Biophysics, Medical School of Istanbul Medeniyet University, Istanbul, Turkey

Don Maisch, PhD, Australia

Martin L. Pall, PhD, Professor Emeritus of Biochemistry and Basic Medical Sciences, Washington State University

Peter Hensinger M.A.

Hugo Schooneveld, PhD, Former senior researcher, Wageningen University, the Netherlands.

Dr. Monika Krout, Germany

Professor Elihu D. Richter MD, MPH at the Occupational and Environmental Medicine Department at the Hebrew University-Hadassah School of Public Health and Community Medicine

Marc Arazi MD of Phonegate Association, France

Marko S. Markov PhD, author of major medical textbooks in bioelectromagnetics.

Wenjun Sun PhD, Professor, Bioelectromagnetics Key Laboratory, Zhejiang University School of Medicine, China

Denis L Henshaw, Fellow Collegium Ramazzini, Emeritus Professor of Human Radiation Effects, Atmospheric Chemistry Group, School of Chemistry, University of Bristol

Christos D. Georgiou, Ph.D. Professor Emeritus of Biochemistry, Biology Department University of Patras, Greece

February 27, 2020

Jeffrey Shuren, M.D., J.D.
Center for Devices and Radiological Health
U.S. Food and Drug Administration
Email: jeff.shuren@fda.hhs.gov

RE: FDA Literature Review on Radiofrequency Radiation and Cancer

Dear Dr. Shuren,

I am writing this letter to detail major incorrect statements and omissions of relevant data in the FDA document titled “Review of Published Literature between 2008 and 2018 of Relevance to Radiofrequency Radiation and Cancer.” I led the design of the National Toxicology Program’s (NTP) toxicity and carcinogenicity studies on cell phone radiation and I strongly believe that the anonymously written FDA document misrepresents the utility of the NTP study for assessing human health risks. In addition, the report’s casual dismissal of both the mechanistic findings and the numerous results from epidemiological studies that have shown increased cancer risks associated with exposure to radiofrequency radiation (RFR) are inconsistent with the FDA’s stated core mission “to protect and promote the public health.”

Regarding the NTP studies on cell phone RFR, an expert peer-review panel discussed the results for 3 days and concluded ([NTP TR-595](#); [Peer-Review Report 2018](#)) that this carefully designed and conducted study provided “clear evidence of carcinogenic activity.” In contrast to the NTP and peer-review conclusions, the FDA claims that whole-body exposures used in the NTP study cannot be related to the local RFR exposures a human receives while using a cell phone. The dismissal of the NTP study results by the FDA is rather peculiar since it was the FDA’s Center for Device and Radiological Health that requested the toxicity and carcinogenicity of RFR in experimental animals ([CDRH nomination of RFR](#)) “to provide the basis to assess the risk to human health,” and FDA scientists were fully aware of the exposure methodology that was used in the NTP study long before those studies were begun.

The NTP study was designed to provide accurate organ-specific dosimetry that could be used to quantify risks for any adverse effect that might be identified. Most people who check on the RF emissions from their cell phones learn that the Federal Communication Commission (FCC) requires that local tissue exposures be lower than 1.6 W/kg averaged over any one gram of tissue. In the NTP study, the exposures to the brain of rats were approximately 1.5, 3.0, and 6.0 W/kg – close to the FCC’s local exposure limit. For experimental studies in small groups of laboratory animals, these values are unusually close to allowable local tissue exposures in humans and require minimal extrapolation to estimate human cancer risk.

The FDA report complains that the whole-body exposures in the NTP study at 6 W/kg was 75 times higher than the exposure limit for the general population (the lower doses were 38- and 19-times that limit for the general population, but only 8- and 4-times the exposure limit for workers). However, whole body exposures provide little information on organ-specific exposure levels. When an individual holds a cell phone next to their head, the important exposure for consideration of health risk is the local exposure. That is why the NTP study design focused on the local exposure intensities. If the animal studies had used the whole-body exposure limit of 0.08 W/kg, then the exposure to the brain of

exposed animals would have been 20-fold less than the FCC's local exposure limit for the general public, i.e., a useless study for assessing human risk. It is misleading for the FDA document to ignore the local exposure limit of 1.6 W/kg and its importance for assessing organ-specific cancer risk.

The FDA document criticizes studies that did not perform histopathology evaluations blinded to the dose group, including the NTP study. However, as was pointed out previously¹, the final diagnosis of lesions in the NTP study was done by a group of pathologists who did not know whether the slides they were examining came from an exposed or an unexposed animal. In addition, for anyone questioning the diagnosis of any tissue in this study, all of the slides from the NTP studies are available for examination at the NTP archives.

The FDA document also suggests without evidence that the carcinogenic effects in rats exposed to 6 W/kg were due to the loss of their ability to maintain their body temperatures during the exposures. However, measured body temperatures were within 1 °C of their normal body temperature, there were no differences in body weights between exposed and sham control rats in the 2-year study, there was no indication of tissue damage in the 28-day study, and there were no exposure-related clinical observations in the 2-year study ([NTP TR-595](#)). Thus, it is clear that animals tolerated the exposure levels used in the NTP study. The peer reviewers of the NTP studies were fully aware of all issues raised in the FDA document, yet still concluded that the results of those studies showed clear evidence of carcinogenic activity. FDA scientists had opportunity to offer criticisms of the NTP study prior to and during the 3-day peer-review, but did not. Did the FDA somehow have an epiphany regarding the human relevance of the NTP cancer data or was there some other factor influencing their decision to dismiss those results?

Lastly, the FDA document misstates the results of the genetic toxicology tests in animals from the NTP study. For example, the FDA document claims there were “no statistically significant increases in DNA damage in female rats or either mouse sex” and the increases in DNA damage in male rats “was not statistically significant,” when in fact there were significant increases and significant trends in DNA damage in the frontal cortex of male mice exposed to GSM or CDMA modulated RFR and in the frontal cortex and hippocampus of male rats exposed to CDMA ([NTP TR-595](#)).

The FDA document also claims there is a “lack of biological mechanistic plausibility,” while eight *in vivo* studies cited in that document provided evidence of increased oxidative stress associated with exposure to RFR and 15 studies provided evidence of genotoxicity. In addition, many relevant *in vivo* studies showing evidence of oxidative stress were not reported in the FDA document and there are many *in vitro* studies that have found oxidative stress associated with exposure to RFR². A true risk analysis should consider both *in vivo* and *in vitro* studies when ascertaining biological mechanistic plausibility. A characteristic of many human carcinogens is the induction of oxidative stress that can subsequently lead to mutations, chromosomal translocations, and genetic instability.³ Thus, there does exist a biologically plausible mechanism for the induction or progression of tumors associated with

1 Melnick RL (2019). Commentary on the utility of the National Toxicology Program study on cell phone radiofrequency radiation data for assessing human health risks despite unfounded criticisms aimed at minimizing the findings of adverse health effects. *Environ Res.* 168:1-6.

2 Yakymenko I, Tsybulin O, Sidorik E, et al. (2016). Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation. *Electromagn Biol Med* 35: 186-202.

3 Smith MT, Guyton KZ, Gibbons CF, et al. (2016). Key characteristics of carcinogens as a basis for organizing data on mechanisms of carcinogenesis. *Environ Health Perspect.* 124:713-721.

exposure to RFR. For studies that did not show evidence of carcinogenicity or genotoxicity, the FDA document did not comment on whether or not those studies were adequately designed with respect to animal group size, exposure levels and duration of exposure.

Regarding human studies, the FDA document cites the study by Little (2012) in which it was reported that glioma trends in the US between 1997 and 2008 have remained relatively constant, but omitted the study by Philips et al. (2018)⁴ that reported a doubling in incidence of glioblastoma (frontal and temporal lobes) in England between 1995 and 2015. The latter study was published in June 2018, which is within the timeframe (August 2018) for epidemiological studies included in the FDA document.

The FDA document identified several human studies that reported risks of glioma, acoustic neuroma, and other tumor types that were increased among cell phone users. In each case, the document focused on limitations in those studies to raise doubt about their reliability for assessing cancer risk. Two limitations specified for most case-control studies included selection and recall bias. However, the FDA document neglected to discuss the impact of the study by Momoli et al.(2017),⁵ which re-analyzed the Canadian data that was included in the Interphone study and showed that there was no effect on the risk of glioma after adjustments were made for selection and recall biases; the odds ratios (OR) for glioma were significantly increased when comparing the highest quartile of use to those who were not regular users whether or not adjustments were made: OR = 2.0, 95% confidence interval 1.2–2.4 without adjustment; OR = 2.2 95% confidence interval 1.3–4.1 with adjustments. Evidently, selection and recall biases do not explain the elevated brain cancer risks associated with use of cell phones in that study.

Thus, while there are reliable animal studies, mechanistic studies, and animal studies showing increased cancer risks associated with exposure to cell phone RFR, the FDA document dismisses nearly the entirety of those studies to enable the agency to conclude that there is insufficient evidence to support a causal association between RFR exposure and tumorigenesis. According to the FDA, animal studies are not useful for studying potential effects in humans (though animal studies are used in drug development) and the human studies “were subject to flaws and inaccuracies.” Yet, every known human carcinogen is carcinogenic in animals when adequately tested. Public health agencies including the NTP, US EPA, IARC, and the FDA have a long tradition of relying on the relevance of rodent toxicology/carcinogenicity studies to identify hazardous agents and assess human health risks in order to implement public health protective policies. The statement in the FDA report that “if any risk does exist, it is extremely low” is very misleading since the FDA has not performed a quantitative risk assessment on any of the available data sets and, because of the widespread use of cell phones in the US and world-wide, even a small increase in cancer risk would have a serious public health impact.

Based on the FDA review, which is not a risk analysis as stated in the document, the message for the general public appears to be that precautionary measures for use of cell phones are not necessary in spite of the fact that numerous studies have provided compelling evidence of increased cancer risk

4 Philips A, Henshaw DL, Lamburn G, O’Carroll MJ. (2018). Brain tumours: rise in glioblastoma multiforme incidence in England 1995-2015 suggests an adverse environmental or lifestyle factor. *J Environ Public Health*. Article ID 7910754,

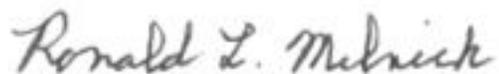
5 Momoli F, Siemiatycki J, McBride ML, et al. (2017). Probabilistic multiple-bias modeling applied to the Canadian data from the Interphone study of mobile phone use and risk of glioma, meningioma, acoustic neuroma, and parotid gland tumors. *Am J Epidemiol*. 186:885-893.

associated with exposure to cell phone RFR. This is an irresponsible message for a government agency that claims its mission is to protect consumers and promote the public health.

The statement on the FDA website (<https://www.fda.gov/radiation-emitting-products/cell-phones/do-cell-phones-pose-health-hazard>) that there is a “scientific consensus on cell phone safety” is totally wrong and should be removed since there is no scientific consensus supporting this claim. In contrast, numerous experts in the field have reported evidence that current levels of cell phone radiation can be harmful to human health.

In conclusion, the FDA document has serious flaws and inaccuracies, as well as omissions of relevant data. Hence, in consideration of public health, it is important that FDA immediately retract their review on radiofrequency radiation and cancer.

Sincerely,

A handwritten signature in cursive script that reads "Ronald L. Melnick".

Ronald L. Melnick, Ph.D.
Retired toxicologist NTP, NIEHS

Press Statement from Dr. Albert Manville on the FDA Report

In a February 13, 2020, news release from MedPage Today, an anonymous, nonscientific review asserts that, according to the FDA, cellphones have ... "no quantifiable adverse health effects in humans," but FDA suggests that further research should be conducted in vulnerable individuals who may be more predisposed to tumors from "short but intense RF exposure" above current limits.

As a certified wildlife biologist and Ph.D. environmental scientist who has studied the impacts of radiation on migratory birds, other wildlife, and humans since the late 1990s, the statement credited to the FDA is preposterous, without any scientific credibility, and at a minimum deserves a retraction by the FDA.

There currently are well over 500 scientific, peer-reviewed papers addressing impacts of non-ionizing, non-thermal radiation on laboratory animals — many of the studies directly applicable to human health and safety. I'm coauthoring a detailed scientific paper on these impacts. When I worked as a wildlife biologist for the U.S. Fish & Wildlife Service for 17 years, I collaborated with the late Dr. Ted Litovitz in 2000. Dr. Litovitz and his colleagues studied the impacts of low-level, non-thermal radiation from the standard 915 MHz cell phone frequency on chicken embryos. In their laboratory studies, control/non-treated embryos suffered no effects, but some of the treated/irradiated embryos died — at levels as low as 1/10,000 the normal level of cell phone radiation exposure to humans. This was an eye-opener! The findings were published by DiCarlo and others in 2002 in the *Journal of Cellular Biochemistry*. Meanwhile, I worked closely with colleagues from Europe, including Balmori, Hallberg, Everaert, and Bauwens on the impacts of cell towers on wild migratory European birds. The results of their field research were equally astounding. Where healthy, breeding bird populations had persisted, once cell towers were installed and operating, nest and site abandonment, plumage deterioration, locomotion problems, reduced survivorship, and death were noted in House Sparrows, White Storks, Rock Doves, Magpies, Collared Doves, and other species. This was documentation in the field of some very troubling consequences of the impacts of cell tower radiation on wildlife.

With these scientific findings, I was instrumental in getting the Department of Interior to convince the First Responder Network Authority, National Telecommunications and Information Administration, Department of Commerce, to begin the process of an Environmental Impact Statement under the National Environmental Policy Act in early 2014. This was the first time one federal department had convinced another department to conduct such a review. While the NEPA review was ultimately scuttled, the results of previous studies clearly showed that radiation has impacts on wildlife, and therefore needed extensive further scientific and public review. The consequences to human health and safety were implicit.

The FDA needs to carefully review the existing and growing scientific record. The current FDA statement is irresponsible, unfounded, and sets a dangerous precedent — especially in this age of "fake news" and "alternative facts." It needs to be corrected or retracted.

Respectfully submitted.

Albert M. Manville, II, Ph.D.; Certified Wildlife Biologist (CWB), The Wildlife Society; Senior Lecturer and Adjunct Professor, Krieger School of Arts and Sciences, Advanced Academic Programs, Johns Hopkins University, Wash DC Campus; and retired Senior Wildlife Biologist, Division of Migratory Bird Management, U.S. Fish & Wildlife Service, Wash. DC HQ Office (17 years);

29/02/2020

To: Jeffery Shuren, Director of the Center for Devices and Radiological Health, FDA.

Re: Response to FDA Center for Devices and Radiological Health (CDRH) Report: *Review of Published Literature between 2008 and 2018 of Relevance to Radiofrequency Radiation and Cancer*

Dear Jeffery,

I wish to voice my concerns about the validity, reliability, and integrity of the report titled: *Review of Published Literature between 2008 and 2018 of Relevance to Radiofrequency Radiation and Cancer*.

To begin, I note that the mission of the FDA's Center for Devices and Radiological Health (CDRH) is as follows:

... the Center for Devices and Radiological Health (CDRH) is responsible for protecting and promoting the public health. We assure that patients and providers have timely and continued access to safe, effective, and high-quality medical devices and safe radiation-emitting products. We assure that patients and providers have timely and continued access to safe, effective, and high-quality medical devices and safe radiation-emitting products. We provide consumers, patients, their caregivers, and providers with understandable and accessible science-based information about the products we oversee. We facilitate medical device innovation by advancing regulatory science, providing industry with predictable, consistent, transparent, and efficient regulatory pathways, and assuring consumer confidence in devices marketed in the U.S.

It is clear that the Center's central mission is to assess medical devices and radiation-emitting products in the field of medicine. Given the ongoing digital transformation of the healthcare industry focusing on the widespread use of wireless devices across hospitals and healthcare facilities, including the Internet of Things, enabled by 5G, there is an onus on the FDA to ensure the general safety of wireless technologies to patients and those with chronic illnesses and disabilities in the face of mounting scientific evidence of the risks posed by wireless technologies of all types.

The FDA seems unaware of, or is it simply ignoring, the overwhelming body of scientific evidence on non-thermal effects, and not just the carcinogenicity, of non-ionizing ionizing radiofrequency radiation (RFR). Take, for example, a recent research review by independent researchers on the health risks of microwave RFR concludes that "*the literature shows there is much valid reason for concern about potential adverse health effects from both 4G and 5G technology*" and that extant research "*should be*

viewed as extremely conservative, substantially underestimating the adverse impacts of this new technology.”¹

The above review by US scientists reported that peer-reviewed studies find the following adverse health effects well below the safety limits set by the FCC and ICNIRP guidelines:

- “carcinogenicity (brain tumors/glioma, breast cancer, acoustic neuromas, leukemia, parotid gland tumors),
- genotoxicity (DNA damage, DNA repair inhibition, chromatin structure), mutagenicity, teratogenicity,
- neurodegenerative diseases (Alzheimer’s Disease, Amyotrophic Lateral Sclerosis),
- neurobehavioral problems, autism, reproductive problems, pregnancy outcomes, excessive reactive oxygen species/oxidative stress, inflammation, apoptosis, blood-brain barrier disruption, pineal gland/melatonin production, sleep disturbance, headache, irritability, fatigue, concentration difficulties, depression, dizziness, tinnitus, burning and flushed skin, digestive disturbance, tremor, cardiac irregularities,
- adverse impacts on the neural, circulatory, immune, endocrine, and skeletal systems.”

The above findings were independently verified by the research team using 5,400 studies in the MedLine database.

Given the foregoing, a question begs as to *whether the FDA had the required competencies to perform its recently published review?* Justification for this question arises from the thousands of relevant studies on the MedLine database identified by independent researchers, as opposed to the 282 studies referenced by the FDA, and the “*approximately 70 relevant epidemiological studies*” mentioned in the Executive Summary and which informed the FDA’s conclusions. The remaining peer-reviewed studies considered by the FDA appear to have been excluded on highly questionable grounds. All this gives the lie to the claim that “[t]he Agency has taken a comprehensive approach to evaluating the available scientific evidence regarding the impact of radiofrequency radiation (RFR) exposure on human health.” Furthermore, however limited the Center’s internal competencies may be, the FDA’s network of experts² are focused on medical practice and the use of various devices employed by health care professionals, and are not subject matter experts in 2-4G, Wifi and 5G telecommunications systems and devices. This is important, as 4G, Wifi and 5G technologies are now being employed across the healthcare industry and in general use across the population. The risks posed by such technologies deserve cross-agency attention and review by independent, competent experts across multiple disciplines, without a single conflict of interest.

Following on from the points made above, I accept that the FDA may call on physicians/scientists with relevant expertise to conduct its scientific reviews, however, the report is silent on which scientists, physicians or engineers conducted the review, the levels of expertise they possessed, and any conflicts of interest they had. This places the second question mark over the trustworthiness of the report—there are, however, several [other] critical questions that require to be answered in full.

Why were ceratin epidemiological studies excluded from the review?

The FDA report is significantly incomplete and therefore inaccurate, given the acknowledged timeframe and intention to include “*more recent, relevant peer-reviewed publications through August 2019.*” A simple example suffices to demonstrate this. The findings of 13 important epidemiological studies are presented below. Also below is a reference to a report that refutes the claims made by the Swedish Radiation Safety Authority cited in the FDA report. The 13 studies were ignored and omitted

¹ Kostoff, R. N., Heroux, P., Aschner, M., & Tsatsakis, A. (2020). Adverse health effects of 5G mobile networking technology under real-life conditions. *Toxicology Letters*.

²² <https://www.fda.gov/media/120990/download>

by those conducting the review. *Why did this omission take place?* The inclusion of the findings of this recent body of research would have made the report’s conclusions untenable. A short review of the 13 studies will support my contention.

First, if the FDA team were using MedLine as indicated, they surely would have identified a study in *The Lancet Neurology*. The findings of this study places the FDA conclusions in serious doubt viz. *“CNS cancer is responsible for substantial morbidity and mortality worldwide, and the incidence increased between 1990 and 2016. Significant geographical and regional variation in the incidence of CNS cancer might be reflective of differences in diagnoses and reporting practices or unknown environmental and genetic risk factors. Future efforts are needed to analyze CNS cancer burden by subtype.”*³ Below is an excerpt from the findings of another relevant study which the FDA ignored.⁴

Table 1 The global death and incidence of all cancers and 29 specified cancer groups in 1990 and 2017

Tumor types	1990				2017			
	Death		Incidence		Death		Incidence	
	Number 10 ³ (95% UI)	Age-standardized per 100,000 (95% UI)	Number 10 ³ (95% UI)	Age-standardized per 100,000 (95% UI)	Number 10 ³ (95% UI)	Age-standardized per 100,000 (95% UI)	Number 10 ³ (95% UI)	Age-standardized per 100,000 (95% UI)
Brain and nervous system cancer	142 (171–117)	3.04 (3.58–2.56)	194 (234–159)	3.97 (4.71–3.33)	247 (265–213)	3.12 (3.34–2.68)	405 (443–351)	5.17 (5.64–4.46)
Thyroid cancer	22 (24–21)	0.55 (0.6–0.52)	95 (101–90)	2.11 (2.24–2.01)	41 (44–40)	0.52 (0.56–0.51)	255 (272–246)	3.15 (3.36–3.03)

While these studies did not link the significant increase in brain and CNS cancer to cellphone and RFR exposure, a recent study by US economists does.⁵ That study demonstrates *“that mobile phone subscription rates are positively and statistically significantly associated with death rates from brain cancer 15-20 years later. As a falsification test, we find few positive associations between mobile phone subscription rates and deaths from rectal, pancreatic, stomach, breast or lung cancer or ischemic heart disease.”* This 25-year cross country analysis provides solid evidence of the link between mobile phone use and cancer when positioned alongside epidemiological studies.

These trends are also evident in the findings of other studies. A research review of the incidence of glioblastoma multiforme tumours in England during 1995–2015 reported a *“a sustained and highly statistically significant ASR [(incidence rate)] rise in glioblastoma multiforme (GBM) across all ages. The ASR for GBM more than doubled from 2.4 to 5.0, with annual case numbers rising from 983 to 2531. Overall, this rise is mostly hidden in the overall data by a reduced incidence of lower-grade tumours.”*⁶ The study did not focus on RFR as the cause, so the findings must be considered ‘open to interpretation’ in this regard, as other environmental mechanisms cannot be ruled out. However, the following figures are clear and unambiguous. In the UK in 1995, 553 frontal lobe tumours were diagnosed in patients, while 1231 were found in 2015. Likewise, 334 temporal lobe tumours were reported in 1995, while 994 were diagnosed in 2015. The increase in these cancers of the CNS are clear and unambiguous. The authors of this study argue that:

³ Patel, A. P., Fisher, J. L., Nichols, E., Abd-Allah, F., Abdela, J., Abdelalim, A., ... & Allen, C. A. (2019). Global, regional, and national burden of brain and other CNS cancer, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016. *The Lancet Neurology*, 18(4), 376-393.

⁴ Lin, L., Yan, L., Liu, Y., Yuan, F., Li, H., & Ni, J. (2019). Incidence and death in 29 cancer groups in 2017 and trend analysis from 1990 to 2017 from the Global Burden of Disease Study. *Journal of hematology & oncology*, 12(1), 96.

⁵ Mialon, H. M., & Nesson, E. T. (2019). The Association Between Mobile Phones and the Risk of Brain Cancer Mortality: A 25-year Cross-country Analysis. *Contemporary Economic Policy*. <https://doi.org/10.1111/coep.12456>.

⁶ Philips, A., Henshaw, D., L Lamburn, G. & M. O'Carroll, (2018). Brain tumours: rise in Glioblastoma Multiforme incidence in England 1995–2015 suggests an adverse environmental or lifestyle factor, *Journal of Environmental and Public Health*, vol. 2018, Article ID 7910754.

“The rise cannot be fully accounted for by promotion of lower-grade tumours, random chance or improvement in diagnostic techniques as it affects specific areas of the brain and only one type of brain tumour. Despite the large variation in case numbers by age, the percentage rise is similar across the age groups, which suggests widespread environmental or lifestyle factors may be responsible. This article reports incidence data trends and does not provide additional evidence for the role of any particular risk factor.”

It is significant that the frontal and temporal lobes receive the greatest exposure to RFR from smartphones and wireless devices.

A comprehensive review of the incidence of primary brain and other central nervous system tumors diagnosed in the United States during the period 2009–2013, found quite small, but statistically significant increases in some categories of CNS tumours and none in others.⁷ To be sure, in this study published in 2016, the increase in the incidence of tumours reported were not as alarming as those in the UK study. However, this is only the first in a series demonstrating an upward trend.

A related U.S. study echoed the previous findings, but found an *“an increasing medulloblastoma incidence in children aged 10–14 years.”*⁸ Another recent study on children found statistically-significant changes in several sub-types of CNS cancers, notably gliomas, in the period 1998-2013.⁹ The latter study concluded that *“Continued surveillance of pediatric CNS tumors should remain a priority given their significant contribution to pediatric cancer deaths.”*

In keeping with studies that provide compelling evidence for concern, a recent review study of epidemiological studies on brain and salivary gland tumours in relation to mobile phone use found the cumulative evidence to be inconclusive but indicated that such cancers may have a long latency (i.e. greater than 15 years) and clear evidence may emerge in the future. Nevertheless, scientists argue that childhood exposure to RFR devices is of significant concern.¹⁰ There is also evidence that RFR from cell phones may be triggering breast cancer in young women who carry their devices on or near their breasts.¹¹ In addition, while the extensive studies by the Hardell Group cited in the FDA review demonstrate increases in cancers of the CNS in Sweden, these findings have been recently replicated in Denmark.¹²

In a general context, the U.S. Center for Disease Control and related research finds that non-Hodgkin lymphomas, central nervous system tumors (including brain cancers), renal, hepatic and thyroid

⁷ Ostrom, Q. T., Gittleman, H., Xu, J., Kromer, C., Wolinsky, Y., Kruchko, C., & Barnholtz-Sloan, J. S. (2016). CBTRUS statistical report: primary brain and other central nervous system tumors diagnosed in the United States in 2009–2013. *Neuro-oncology*, 18(suppl_5), v1-v75.

⁸ Khanna, V., Achey, R. L., Ostrom, Q. T., Block-Beach, H., Kruchko, C., Barnholtz-Sloan, J. S., & de Blank, P. M. (2017). Incidence and survival trends for medulloblastomas in the United States from 2001 to 2013. *Journal of neuro-oncology*, 135(3), 433-441.

⁹ Withrow, D. R., de Gonzalez, A. B., Lam, C. J., Warren, K. E., & Shiels, M. S. (2018). Trends in pediatric central nervous system tumor incidence in the United States, 1998-2013. *Cancer Epidemiology and Prevention Biomarkers*, cebp-0784.

¹⁰ Rööslä, M., Lagorio, S., Schoemaker, M. J., Schüz, J., & Feychting, M. (2019). Brain and Salivary Gland Tumors and Mobile Phone Use: Evaluating the Evidence from Various Epidemiological Study Designs. *Annual review of public health*, 40.

¹¹ West, J. G., Kapoor, N. S., Liao, S. Y., Chen, J. W., Bailey, L., & Nagourney, R. A. (2013). Multifocal breast cancer in young women with prolonged contact between their breasts and their cellular phones. *Case reports in medicine*, 2013.

¹² Swedish Radiation Protection Foundation (2017). Brain tumors are increasing in Denmark https://www.stralskyddsstiftelsen.se/wp-content/uploads/2017/01/denmark_cnstumorrising_2017-01-20.pdf

tumours have increased recently among adolescent Americans.^{13, 14} When comparing the Annual Average Total and Average Annual Age-Adjusted Incidence Rates for Children and Adolescents of Brain and Other Central Nervous System Tumors from 2009-2013⁴ and 2012-2016¹² an increase in total cases of 0-19 year olds from 23,522 to 24,931 is found, with the annual average increasing from a rate of 5.70 in 2012 to 6.06 to 2016. Thus, many scientists conclude that microwave radio frequency radiation has a significant role to play in the increasing rates of particular types of CNS cancers being reported.

A senior epidemiologist at US healthcare provider Kaiser Permanente, Dr. De-Kun Li, believes that while the increase in brain tumors is worrisome, increases in colorectal cancer is even more troubling, particularly as he believes RFR is implicated due to the manner in which people carry their smartphones in the front and back pockets of their pants and jeans. Take, for example, in 2019, the journal *Cancer* described a rising incidence of colorectal cancer among young Americans, with rectal cancers being slightly higher than colon cancers.¹⁵ Another contemporary study found significant increases in colorectal cancer among people under 50 in Denmark, New Zealand, and the UK since 2009.¹⁶ Yet another study of colorectal cancer in young adults in 20 European countries over the last 25 years found that over the last 10 years, the incidence of colorectal cancer increased 8% per year among people in their 20s, by 5% for people in their 30s, and by 1.6% for those in their 40s.¹⁷ Dr. De-Kun Li maintains that *“When placed in trouser pockets, the phones are in the vicinity of the rectum and the distal colon and these are the sites of the largest increases in cancer.”* While phones go into standby mode where telephone calls are concerned, most young people have WiFi, Bluetooth and 4G data enabled. This increases the level and incidence of exposure, as their apps keep their smartphones active on a continuous basis. Thus, other environmental, diet and lifestyle factors aside, wireless microwave radio frequency radiation is strongly implicated as a direct or indirect (e.g. co-carcinogen) in this latest ‘uptick’ in cancers.

Again the weight of the scientific evidence is considerable. If the findings of the above studies are accurate and generalizable, then the rates for frontal and temporal lobe tumours may increase significantly, as they more than doubled over a 20-year period in the UK, or increase in line with high RFR exposure, as RFR is now accepted as either a causal or a contributory mechanism in the occurrence of brain tumours and other cancers.

Serious questions on the trustworthiness of the report

Focusing on the report itself, and in regard to the probable deficiencies in scientific expertise among the authors of the review, the FDA has questions to answer in regard to the report’s...

- (a) scientific accuracy and integrity;

¹³ Siegel, D. Li, S J., Henley, J., Wilson, R., Buchanan Lunsford, N., Tai, E. Van Dyne, E. (2018) Incidence rates and trends of pediatric cancer — United States, 2001–2014, American Society of Pediatric Hematology Oncology Conference, Centers for Disease Control and Prevention, Atlanta, Georgia, United States http://aspho.org/uploads/meetings/2018annualmeeting/Abstracts_for_Website.pdf

¹⁴ Ostrom, Q. T., Gittleman, H., Truitt, G., Boscia, A., Kruchko, C., & Barnholtz-Sloan, J. S. (2018). CBTRUS statistical report: primary brain and other central nervous system tumors diagnosed in the United States in 2011–2015. *Neuro-oncology*, 20(suppl_4), iv1-iv86.

¹⁵ Virostko, J., Capasso, A., Yankeelov, T. E., & Goodgame, B. (2019). Recent trends in the age at diagnosis of colorectal cancer in the US National Cancer Data Base, 2004-2015. *Cancer*.

¹⁶ Araghi, M., Soerjomataram, I., Bardot, A., Ferlay, J., Cabasag, C. J., Morrison, D. S., ... & Engholm, G. (2019). Changes in colorectal cancer incidence in seven high-income countries: a population-based study. *The Lancet Gastroenterology & Hepatology*, 4(7), 511-518.

¹⁷ Vuik, F. E., Nieuwenburg, S. A., Bardou, M., Lansdorp-Vogelaar, I., Dinis-Ribeiro, M., Bento, M. J., ... & Suchanek, S. (2019). Increasing incidence of colorectal cancer in young adults in Europe over the last 25 years. *Gut*, gutjnl-2018.

- (b) systematic distortion and misrepresentation of the findings of peer-reviewed studies in reputable journals;
- (c) dismissal of scientific evidence on spurious “limitations” grounds;
- (d) bias and systematic omission of studies;
- (e) incorrect and misleading statements;
- (f) lack of transparency.

In the round, and in my view as a scientist, this review fails to meet the basic criteria set for valid and reliable scientific research. You might ask where is the objective proof of my assertion? In answering this, I contend that if a truly independent group of scientists conducted an equally rigorous review of the same literature and came to different conclusions then this would support my argument as to the trustworthiness of your report. Was there such a review? Yes, there was. I now discuss this.

The WHO’s IARC Advisory Group comes to different conclusions using the same body of evidence

In March 2019, based on what was similar laboratory and epidemiological research evidence, an Advisory Group of 29 scientists from 18 countries recommended that non-ionizing radiofrequency radiation (RFR) receive High Priority from by the WHO’s International Agency for Research on Cancer (IARC) Monographs programme during 2020–24. In doing so, the Advisory Group voiced concern about the health risks identified by the research they reviewed over the past 8 years, since non-ionizing radiofrequency radiation was classified as Class 2B carcinogen (see below¹⁸). Above I identified recent epidemiological studies on the incidence of primary brain and other central nervous system tumors and colorectal cancers in young adults, which would only serve to strengthen their recommendations, had they been available at the time of the review. These studies indicate clear risks to adolescents and young adults from smartphone use and the global practice of carrying smartphones in front and back pants/jeans pockets, all things considered.

In addition, there is an increasing body of independent analyses of peer-reviewed scientific research, which concludes that non-ionizing RFR should be reclassified as a Class 1 carcinogen.^{19, 20, 21, 22} It is more likely, however, that the IARC Advisory Group recommendation will result in RFR achieving at least a Class 2A probable carcinogen status. However, former ICNIRP scientist James C. Lin²³ argues in relation to the NTP and Ramazini Institute peer-reviewed findings in 2018: *“The time is right for the IARC to upgrade its previous epidemiology based classification of RF exposure to higher levels in terms of the carcinogenicity of RF radiation for humans. Recently, two relatively well-conducted RF and microwave exposure studies employing the Sprague–Dawley strain of rats—without, however, using any cancer-promoting agents (or cocarcinogens)—showed consistent results in significantly increased*

¹⁸<https://www.iarc.fr/news-events/report-of-the-advisory-group-to-recommend-priorities-for-the-iarc-monographs-during-2020-2024/>

https://monographs.iarc.fr/wp-content/uploads/2019/10/IARCMonographs-AGReport-Priorities_2020-2024.pdf.

¹⁹Kostoff, R. N., Heroux, P., Aschner, M., & Tsatsakis, A. (2020). Adverse health effects of 5G mobile networking technology under real-life conditions. *Toxicology Letters*.

²⁰Miller, A. B., Morgan, L. L., Udasin, I., & Davis, D. L. (2018). Cancer epidemiology update, following the 2011 IARC evaluation of radiofrequency electromagnetic fields (Monograph 102). *Environmental research*, 167, 673-683.: [//www.sciencedirect.com/science/article/pii/S0013935118303475](http://www.sciencedirect.com/science/article/pii/S0013935118303475)

²¹Belpomme, D., Hardell, L., Belyaev, I., Burgio, E., & Carpenter, D. O. (2018). Thermal and non-thermal health effects of low intensity non-ionizing radiation: An international perspective. *Environmental Pollution*, 242, 643-658.

²² Kostoff, R. N., Heroux, P., Aschner, M., & Tsatsakis, A. (2020). Adverse health effects of 5G mobile networking technology under real-life conditions. *Toxicology Letters*.

²³ James C. Lin is Professor of Physiology and Biophysics University of Illinois, Chicago.

total primary cancer or overall tumor rates in animals exposed to RF radiation.”²⁴ Thus, for all intents and purposes, respected independent scientists are of the strong opinion that RFR is at least a Class 2A probable carcinogen and, given the recent experimental and epidemiological evidence, almost certainly a Class 1 carcinogen. It is also noteworthy that Professor Lin’s assessment of the validity and reliability of the NTP and Ramazzini studies also calls into question the conclusions of the report by your Center.

FDA’s confused and contradictory approach to regulating carcinogens

During the second half of 2019, the FDA investigated “*the detection of a contaminant known as N-Nitrosodimethylamine (NDMA) in ranitidine medications, commonly known by the brand name Zantac.*”²⁵ In an update to its previous announcement, the FDA “*advised companies to recall their ranitidine if testing shows levels of NDMA above the acceptable daily intake (96 nanograms per day or 0.32 parts per million for ranitidine).*” N-nitrosodimethylamine (NDMA) is an IARC Class 2A probable carcinogen. That FDA recall affects Zantac and all medications containing ranitidine as NDMA was found in these over-the-counter indigestion drugs. In October, *Scientific American* published an article titled: *What We Know about the Possible Carcinogen Found in Zantac*. *Scientific American* reported that the NDMA found in this medication is classified as a probable human carcinogen based on results from laboratory tests on rats. There is little evidence that it causes cancer in humans, despite the WHO’s IARC classification of it as a Class 2A carcinogen. Please note that the majority of Class 2A/B carcinogens are linked with an increased risk of cancer in individuals that are periodically exposed to them. That is, the frequent ingestion of NDMA over a particular period of time increases the risk, but not the certainty of developing cancer. Digestion remedies such as Zantac were nevertheless withdrawn because of “*fears it contains traces*” of NDMA.

To reiterate, while currently a Class 2B carcinogen as indicated above, scientific evidence and expert opinion currently places RFR in the Class 2A category and probably in the Class 1 category. The WHO/IARC is expected to reclassify it as such soon. With the proliferation of 4G, WiFi and 5G, adults and children are exposed to a scientifically recognized toxin and carcinogen, 24 hours a day, 7 days a week, from multiple sources in the home, school, the workplace, and society. The FCC and ICNIRP thermal safety levels do not protect adults or children from exposure to this carcinogen and the risks it poses. Risks much greater than that which NDMA poses in Zantac. Note that the risk here from RFR is systemic and individual, not just individual as in the case of Zantac, and is one that must be mitigated by minimizing or eliminating exposure, where possible. Thus, the FDA has demonstrated that it does not really understand the risks that carcinogens such as RFR pose to humans.

Why were the authors of the FDA review not named?

As indicated previously, it is most troubling that this report has no authors. On the FDA website on the scientific integrity page, the following text appears.

*“Our scientific experts may hold differing views on what they conclude from data. There may be multiple options that can be considered during policy development or regulatory decision-making. However, in reaching our conclusions through a deliberative scientific process, FDA strives to present an evaluation and analysis of the data—including uncertainties—in an unbiased manner.”*²⁶

²⁴ Lin, J. C. (2019). The Significance of Primary Tumors in the NTP Study of Chronic Rat Exposure to Cell Phone Radiation [Health Matters]. IEEE Microwave Magazine, 20(11), 18-21.

²⁵ <https://www.fda.gov/news-events/press-announcements/statement-new-testing-results-including-low-levels-impurities-ranitidine-drugs>

²⁶ <https://www.fda.gov/science-research/about-science-research-fda/scientific-integrity-fda>

In light of the report's provenance and lack of transparency in its authorship and conduct, the following questions require attention.

- Did the in-house scientific experts at the FDA's Center for Devices and Radiological Health (CDRH) refuse to be associated with the published conclusions?
- How can the scientific community accept the validity and reliability of an anonymous report, given its mysterious provenance?
- How are we to evaluate any conflicts of interest among the authors of the report?

It is notable that as Director of the Center for Devices and Radiological Health, you have not put your name to this report nor signed off on it, as one would have expected. *Why is this?*

There are too many question marks over this report for it to be accepted as valid and reliable by any reasonable person, let alone a member of the scientific community. Thus, one may ask if the FDA has failed in its statutory duty to protect public health by promulgating the falsehood that RFR is not a carcinogen? Has it, therefore, put the health of US citizens, and children in particular, at significant risk, the very antithesis to its overall mission to "*protect the public health*"?

Yours Sincerely,



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Statements to the FDA by Alfonso Balmori, BSc, Lennart Hardell MD, Paul Heroux PhD, Devra Davis PhD, Elihu D. Richter MD, MPH, Alvaro de Salles, PhD, Dr. Marc Arazi, Marko S. Markov PhD, Martin L. Pall, PhD, Hiie Hinrikus, PhD, DSc, David O. Carpenter MD, Suleyman Dasdag PhD.

Statement by Wildlife Biologist Alfonso Balmori, BSc on the FDA Review of Cell Phone Radiation and Cancer

The FDA review omits an evaluation of the science on wireless radiation impacts to trees and wildlife. Electromagnetic radiation is a form of environmental pollution which may hurt wildlife. I am providing examples of my published research below as examples of this scientific evidence.

I have co-published research entitled "[Radiofrequency radiation injures trees around mobile phone base stations](https://www.ncbi.nlm.nih.gov/pubmed/27552133)" finding harm to trees near base stations (cell antennas) in a long term field monitoring study in two cities. We measured the radiofrequency radiation levels and found significant differences between the damaged side facing the cell phone mast and the opposite side. Our statistical analysis demonstrated that electromagnetic radiation from mobile phone masts was harmful to the trees. The damage usually starts on one side of the tree, then extends to the whole tree over time. <https://www.ncbi.nlm.nih.gov/pubmed/27552133>

I have also published an [experimental study](https://www.ncbi.nlm.nih.gov/pubmed/20560769) where we exposed eggs and tadpoles of the common frog (*Rana temporaria*) to the electromagnetic radiation from mobile (cell) phone antennas located at a distance of 140 meters. The experiment lasted two months, from the egg phase until an advanced phase of tadpole prior to metamorphosis. In this study, we found the exposed group had altered development and a higher mortality rate in comparison to the unexposed frogs. <https://www.ncbi.nlm.nih.gov/pubmed/20560769>

In addition, my [research](https://www.ncbi.nlm.nih.gov/pubmed/25747364) has documented anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation. For example, exposure at levels that are found in the environment (in urban areas and near base stations) may particularly alter the receptor organs to orient in the magnetic field of the earth. These results could have important implications for migratory birds and insects, especially in urban areas, but could also apply to birds and insects in natural and protected areas where there are powerful base station emitters of radio frequencies. Therefore, more research on the effects of electromagnetic radiation in nature is urgently needed to investigate this emerging threat. At the present time, there are reasonable grounds based on scientific evidence for believing that microwave radiation constitutes an environmental and health hazard. Existing guidelines are not protective. The paper "Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation" is online at <https://www.ncbi.nlm.nih.gov/pubmed/25747364>

Another research study I co-published in the journal *Electromagnetic Biology and Medicine* is entitled "[The urban decline of the house sparrow \(*Passer domesticus*\): a possible link with](https://www.ncbi.nlm.nih.gov/pubmed/25747364)

[electromagnetic radiation.](#)” Between October 2002 and May 2006, point transect sampling was performed at 30 points during 40 visits in Valladolid, Spain. At each point, we carried out counts of sparrows and measured the mean electric field strength (radio frequencies and microwaves: 1 MHz–3 GHz range). Significant declines ($P = 0.0037$) were observed in the mean bird density over time, and significantly low bird density was observed in areas with high electric field strength. The logarithmic regression of the mean bird density vs. field strength groups (considering field strength in 0.1 V/m increments) was $R = -0.87$ ($P = 0.0001$). The results of this article support the hypothesis that electromagnetic signals are associated with the observed decline in the sparrow population. We conclude that electromagnetic pollution may be responsible, either by itself or in combination with other factors, for the observed decline of the species in European cities during recent years. The apparently strong dependence between bird density and field strength according to this work could be used for a more controlled study to test the hypothesis. <https://www.ncbi.nlm.nih.gov/pubmed/17613041>

In another study, monitoring of a white stork population in the vicinity of Cellular Phone Base Stations was carried out, with the objective of detecting possible effects. The total productivity, in the nests located within 200 meters of antennae, was 0.86 ± 0.16 . For those located further than 300m, the result was practically doubled, with an average of 1.6 ± 0.14 . Very significant differences among the total productivity were found ($U = 240$, $p = 0.001$, Mann-Whitney test). Twelve nests (40%) located within than 200m of antennae never had chicks, while only one (3.3%) located further than 300m had no chicks. The electric field intensity was higher on nests within 200m (2.36 ± 0.82 V/m) than on nests further than 300m (0.53 ± 0.82 V/m). The study concludes that, “these results are compatible with the possibility that microwaves are interfering with the reproduction of white storks and would corroborate the results of laboratory research by other authors”. <https://www.tandfonline.com/doi/abs/10.1080/15368370500205472>

A review on the impact of radiofrequency radiation from wireless telecommunications on wildlife is presented in “[Electromagnetic pollution from phone masts. Effects on wildlife](#)” published in the journal Pathophysiology. Electromagnetic radiation is a form of environmental pollution which may hurt wildlife. Phone masts located in their living areas are irradiating continuously some species that could suffer long-term effects, like reduction of their natural defenses, deterioration of their health, problems in reproduction and reduction of their useful territory through habitat deterioration. Electromagnetic radiation can exert an aversive behavioral response in rats, bats and birds such as sparrows. Therefore microwave and radiofrequency pollution constitutes a potential cause for the decline of animal populations and deterioration of health of plants living near phone masts. To measure these effects urgent specific studies are necessary.

<https://www.ncbi.nlm.nih.gov/pubmed/?term=Electromagnetic+pollution+from+phone+masts.+Effects+on+wildlife>

Despite the widespread use of wireless telephone networks around the world, authorities and researchers have paid little attention to the potential harmful effects of mobile phone radiation on wildlife. This paper briefly reviews the available scientific information on this topic and recommends further studies and specific lines of research to confirm or refute the experimental

results to date. Controls must be introduced and technology rendered safe for the environment, particularly, threatened species. <https://www.ncbi.nlm.nih.gov/pubmed/25089692>

Atmospheric electrical discharges during thunderstorms, and the related electromagnetic fields (EMFs)/waves called sferics, can be sensed by humans at long distances through a variety of symptoms, mainly headache, fatigue, etc. Up to today there is no explanation for this association. Sferics consist of partially polarized electromagnetic pulses with an oscillating carrier signal in the very low frequency (VLF) band and a pulse repetition frequency in the extremely low frequency (ELF) band. Their ELF intensity may reach ~5 mV/m at global ranges, and ~0.5 V/m at ~1000 km from the lightning. The health symptoms associated with sferics are also associated with antennas of mobile telephony base stations and handsets, which emit radio frequency (RF) radiation pulsed on ELF, and expose humans at similar or stronger electric field intensities with sferics. According to the Ion Forced-Oscillation mechanism, polarized ELF EMFs of intensities down to 0.1–1 mV/m are able to disrupt any living cell's electrochemical balance and function by irregular gating of electro-sensitive ion channels on the cell membranes, and thus initiate a variety of health symptoms, while VLF EMFs need to be thousands of times stronger in order to be able to initiate health effects. We examine EMFs from sferics in terms of their bioactivity on the basis of this mechanism. We introduce the hypothesis that stronger atmospheric discharges may reasonably be considered to be ~70% along a straight line, and thus the associated EMFs (sferics) ~70% polarized. We find that sferics mainly in the ELF band have adequate intensity and polarization to cause biological/health effects.

We provide explanation for the effects of sferics on human/animal health on the basis of this mechanism. <https://www.ncbi.nlm.nih.gov/pubmed/28558424>

It is documented that a few days or weeks before major Earthquakes (EQs) there are changes in animal behavior within distances up to 500 km from the seismic epicenter. At the same time Seismic Electric Signals (SES), geomagnetic and ionospheric perturbations, are detected within similar distances. SES consist of single unipolar pulses, and/or groups of such pulses called "SES activities" with an average frequency between successive pulses on the order of ~0.01 Hz and electric field intensity on the order of ~10⁻⁵-10⁻⁴ V/m (Frazer-Smith et al., 1990; Rikitake, 1998; Varotsos et al., 1993, 2011, 2019; Hayakawa et al., 2013; Grant et al., 2015). We show that the SES activities can be sensed by living organisms through the "Ion Forced-Oscillation Mechanism" for the action of Electromagnetic Fields (EMFs) on cells, according to which polarized EMFs can cause irregular gating of electro-sensitive ion channels on the cell membranes with consequent disruption of the cell electrochemical balance (Panagopoulos et al., 2000, 2002, 2015). This can be sensed by sensitive animals as discomfort in cases of weak and transient exposures, and may even lead to DNA damage and serious health implications in cases of intense exposure conditions (as in certain cases of man-made EMF exposures). Moreover, we show that the geomagnetic and ionospheric perturbations cannot be sensed through this mechanism. The same mechanism has explained meteoropathy, the sensing of upcoming thunderstorms by sensitive individuals, through the action of the EMFs of lightning discharges (Panagopoulos and Balmori, 2017). The present study shows that centuries-long anecdotal rumors of animals sensing intense upcoming EQs and displaying unusual behavior, lately documented by systematic studies, are now explained for the first time on the basis of the

electromagnetic nature of all living organisms, and the electromagnetic signals emitted prior to EQs. <https://www.ncbi.nlm.nih.gov/pubmed/28558424>

Signed, Alfonso Balmori, BSc Biologist. Spain
[Alfonso Balmori on researchgate.](#)

Paul Heroux PhD Statement in Response to the FDA Report on Cell Phone Radiation

The FDA Report stated, "We do not know if there is a causal effect or if these results are due to weakening of the immune response due to animal stress from cyclic heating and thermoregulation decline in aging animals leading to whole-body temperature increase, possible sleep disruption due to the cyclic heating, or due to an RF-specific effect that has not been identified and has an adverse effect before heating becomes the dominant safety issue."

Response by Paul Heroux PhD

"FDA is pushing red herrings to avoid the inevitable conclusion that electromagnetic fields have important carcinogenic effects on animals below thermal levels.

This is an apparent attempt to confuse the discussion by invoking an "immune" mechanism driven by heat and sleep disturbances, and other ghost mechanisms that would inevitably turn out to be dead ends.

These surprising comments should not distract us from (1) at least four previous spectacular animal experiments linking fields to cancer, from (2) the drastic action of fields on human cancer cells at field intensities nowhere near the thermal limit, as well as (3) the literature linking fields to reactive oxygen species and mutations.

An institution (FDA) displaying such a fundamental reluctance to acknowledge evidence should abstain from commenting on the NTP study.

The FDA Report stated, "It is possible that any form (ambient, IR, ultrasound) of cyclic whole-body heating of this magnitude may cause similar findings, but no such studies have been conducted to date."

Response by Paul Heroux PhD

"This is a way to extend the lie about health impacts of electromagnetic fields by directing attention to some form of further investigation that would allow industry to proceed with increases in human exposures, while we await the results of yet another waste of time."

Paul Héroux, PhD
Professor of Toxicology and Health Effects of Electromagnetism
McGill University Medicine

Department of Surgery, McGill University Health Center

Statement by Christos D. Georgiou, Ph.D.

The issued by FDA "literature review" conclusion that there are no connections between cell phones and cancer is not valid, as it is contradicted, at least, by the classification, by IARC-WHO, of cell phone-emitted EMF as possibly carcinogenic to humans (Group 2B). The numerous research studies IARC reviewed to base the Group 2B classification also included a study of mine (cited in the IARC-WHO 2013 report; https://www.ncbi.nlm.nih.gov/books/NBK304630/pdf/Bookshelf_NBK304630.pdf, pages 101,103,121), which advances the free radical pair mechanism of non thermal induction of carcinogenic oxidative stress by exposure to low-intensity RF radiation.

Christos D. Georgiou, Ph.D.
Professor Emeritus of Biochemistry
Biology Department
University of Patras, Greece

Statement by Anthony B. Miller MD

“Radiofrequency is an established carcinogen. Cell phones held close to the head will substantially increase the risk of a type of brain cancer—glioblastoma,” stated Dr. Anthony B. Miller, Professor Emeritus at the Dalla Lana School of Public Health, University of Toronto and former Director of the Epidemiology Unit of the National Cancer Institute of Canada. Miller also served as a Senior Epidemiologist, International Agency for Research on Cancer and published a major [research review](#) in 2018, concluding that “based on the evidence reviewed it is our opinion that IARC's current categorization of RFR as a Possible Human Carcinogen (Group 2B) should be upgraded to Carcinogenic to Humans (Group 1). Miller recommends people use safer wired technology rather than wireless technology, “We should do all we can to reduce exposure.”

Statement by Devra Davis PhD

“This astonishing report from an agency charged with protecting public health should be retracted. It does not meet minimum standards of scientific reporting or review, as it takes a skewed look at science, lists neither authors nor reviewers. It ignores the recent [Yale study](#) supported by the American Cancer Society linking cell phone use to thyroid cancer. It does not consider that antiquated phone test methods [do not protect](#) anyone from microwave radiation emitted by phones or other devices. It ignores [repeated calls](#) from the American Academy of Pediatrics and numerous experts in the field of child health to take into account the [unique vulnerability](#) of children, pregnant women and young adults. No reference is made to a growing [body of research](#) showing [brain damage](#) and [headache](#) and [replicated research](#) showing

memory damage in teens after just one year of cell phone use,” stated [Devra Davis PhD, MPH](#), President of the Environmental Health Trust.

Prof. Suleyman Dasdag, Department of Biophysics, Medical School of Istanbul Medeniyet University, Istanbul, Turkey, also noted: “Mobile phones are not as innocent as they seem. In [my studies to date](#), I have found that wireless radiofrequency (RF) does not affect every organ in the same way and very different parameters are important in the emergence of effects. In our two studies on RF and the brain in 2015 and our study published this year, we found that RFs may affect key molecules. In addition, we observed in our brain study that RF radiation can affect the death of brain cells. I also want cell phones not to cause brain tumors, but our studies and the published studies we have reviewed are in the direction that the risk will increase even more after 5G.”

Martin L. Pall, PhD, Professor Emeritus of Biochemistry and Basic Medical Sciences, Washington State University who has published [extensively](#) on how EMFS activate Voltage-Gated Calcium Channels which can lead to tumor promotion, disputed the report’s conclusions that cellphones are safe, noting that, “EMFs produce double strand DNA breaks which cause cancer via chromosomal rearrangements, copy number mutations and gene-amplification. EMFs also cause oxidized bases including 8-OHdG, which produce transition and transversion mutations such that when these occur in oncogenes or tumor suppressor genes, these mutations have important roles in causing cancer.”

“This report is pure nonsense! It is as though the author didn’t read any of the literature they cite,” stated David O. Carpenter MD, Director, Institute for Health and the Environment, University at Albany who has repeatedly documented adverse effects over 4 decades of [published research](#).

“Radiofrequency radiation should be regarded as a human carcinogen causing glioma,” stated Lennart Hardell MD, an advisor to the World Health Organization’s International Agency for Research on Cancer, who has published several studies finding associations between cancer and people who use cell phones regularly. He referred to one of his [published research](#) reviews concluding that radiofrequency is a carcinogen.

“The latest report by the National Toxicology Program is a game changer. We also should not ignore [case series reports](#) on cancer in military workers with whole body exposure to RF/MW, stated Professor Elihu D. Richter MD, MPH at the Occupational and Environmental Medicine Department at the Hebrew University-Hadassah School of Public Health and Community Medicine.

“Due to the recent results described in many peer reviewed scientific papers published in the international literature showing significant human health risks (including cancer) at levels of EMF exposures well below the available recommended limits (e.g., ICNIRP, FCC/IEEE/ANSI). We believe that the Precautionary Principle should be urgently adopted and the population

should be fully informed on the best ways to reduce their exposure and health impacts, “ stated Alvaro de Salles, Ph. D. Professor at Federal University of Rio Grande do Sul, Porto Alegre, Brazil whose [research studies](#) have found children are more exposed to RF from cell phones.

"The FDA's position is totally incomprehensible especially since the findings of the Phonegate scandal have revealed the deception by cell phone manufacturers who have knowingly overexposed all cell phone users to excessive radiation for decades," stated Dr. Marc Arazi of [Phonegate Association](#).

"Mankind is being forced to participate in a giant "experiment" without protocol, without collection of data and without adequate evaluation of the cocktail of EMF humankind is exposed to every day. The engineering community needs to recognize the fact that there is a difference between experimental exposure and continuous exposure to multiple frequencies and modulations. The FDA as well as ICNIRP have failed to investigate this to assure public safety, " stated Marko S. Markov PhD, [author](#) of major medical textbooks in bioelectromagnetics.

“Tissue heating is certainly not the only effect caused by radiofrequency radiation.,” stated Hiie Hinrikus, PhD, DSc, Professor Emeritus Centre for Biomedical Engineering at the Tallinn University of Technology who has published several [research studies](#) on microwave radiation. “Hundreds of studies performed by independent researchers have convincingly approved biological effects caused by low-level radiofrequency radiation in animals and humans at constant temperature. The reason is coherent nature of radiofrequency radiation. During billions years, living nature has been adapted to natural solar radiation, radiofrequency radiation is in principle different from solar radiation. Sun emits irregular incoherent radiation in wide frequency spectrum whereas technical radiofrequency sources emit regular coherent single-frequency radiation. The impact of irregular random and regular coherent electromagnetic radiation on living systems is different. Irregular radiation causes random forces and movement in tissues and can create only tissue heating. Coherent radiation causes regular forces and synchronous movement affecting simultaneously large amounts of molecules and cells in tissues. Therefore, the impact of radiofrequency radiation is much stronger than the heating effect only. This is convincingly approved also in microwave chemistry.”



	Date	Reference
Department	Your date	Your reference

CEO Dr. Andrew Zuckerman
 Montgomery County Schools
 Carver Educational Services Center
 850 Hungerford Drive
 Rockville, MD 20850
 USA

November 30, 2015

To Montgomery County Public Schools' CEO Dr. Andrew Zuckerman

Regarding: Wireless technology should not be used in schools or pre-schools due to health risks for children and employees

It has come to our attention that MCPS has measured the radiofrequency radiation in several of your schools. We also understand the district is sharing information with parents and teachers and staff about the potential health risks of wireless radiation. Based on current published scientific studies, we urge your administration to educate themselves on the potential risks from wireless technologies in schools, and to choose wired teaching technologies. The well-being and educational potential of children depends on it.

High-speed connectivity to schools is important but it can be a wired connection instead of Wi-Fi. Wireless classroom infrastructure and wireless devices for schoolchildren should be avoided for these reasons:

- Wireless radiofrequency radiation emissions were classified as a Possible Human Carcinogen (group 2B) by the World Health Organization International Agency for Research on Cancer (IARC) in May 2011. One of the signers, Dr Hardell, was part of the evaluation group.
- The IARC classification holds for *all forms of radio frequency radiation* including RF-EMF emissions from wireless transmitters (access points) in schools, tablets and laptops.
- Epidemiological studies show links between radiofrequency radiation (RFR) exposure and cancers, neurological disorders, hormonal changes, symptoms of electrical hypersensitivity (EHS) and more. Laboratory studies show that RFR exposure increases risk of cancer, abnormal sperm, learning and memory deficits, and heart irregularities. Foetal exposures in both animal and human studies may result in altered brain development in the young offspring, with disruption in learning, memory and behaviour.
- The research showing increased brain cancer risk *has strengthened* since the IARC 2011 classification as new research has been published which repeatedly shows a significant association after RF exposure. In addition, tumour promotion studies have now been replicated showing cancer promotion after exposures at low levels. Therefore, it is our opinion and that of many colleagues that the current IARC cancer risk classification should move to an *even higher* risk group.

The evidence for these statements is based on hundreds of published, peer-reviewed scientific studies that report adverse health effects at levels much lower than current ICNIRP and FCC

public safety limits. Compliance with government regulations does not mean that the school wireless environment is safe for children and staff (especially pregnant staff).

As researchers in cancer epidemiology and radio frequency radiation exposures, we have published extensively in this area and it is our opinion that schools should choose wired Internet connections. Multiple epidemiological research studies show that exposures equivalent to 30 minutes a day of cell phone use over ten years results in significantly increased brain cancer risk (Please update your Radio Frequency FAQ on cancer risk with this information).

What will be the health effect for a child exposed all day long in school for 12 years? Wireless networks in schools results in full body low level RF-EMF exposures that can have a cumulative effect on the developing body of a child. No safe level of this radiation has been determined by any health agency and therefore we have no safety assurances. Cancers can have long latency periods (time from first exposure until diagnosis) and it will take decades before we know the full extent of health impacts from this radiation. The statistics and effects will be borne by the children you serve.

Wi-Fi in schools, in contrast to wired Internet connections, will increase risk of neurologic impairment and long-term risk of cancer in students. Promoting wireless technology in schools disregards the current health warnings from international science and public health experts in this field.

We recommend that your school district install wired Internet connections and develop curriculum that teaches students at all ages safer ways to use their technology devices. If cell phones and other wireless devices are used in the school curriculum (as many schools are now doing with Bring your Own Device Policy) then there should be educational curriculum in place and well posted instructions in classrooms so that the students and staff use these devices in ways so that exposure to the radiation is reduced as much as possible.

Supporting wired educational technologies is the safe solution in contrast to potentially hazardous exposures from wireless radiation.

Respectfully submitted



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April 21, 2022

The Honorable Jessica Rosenworcel, Chairwoman
Federal Communications Commission
45 L Street NE
Washington, DC 20554

RE: August 13, 2021 judgment by the U.S. Court of Appeals for the District of Columbia Circuit, in Environmental Health Trust et al. v. the FCC

Dear Chairwoman Rosenworcel,

In response to the judgment by the U.S. Court of Appeals in the Environmental Health Trust case, I am requesting that appropriate actions be taken immediately to wireless radiofrequency radiation levels. I request that the FCC ensure an up to date examination of its wireless radiofrequency radiation regulations by reopening Docket 13-84 ("Reassessment of FCC Radiofrequency Exposure Limits and Policies") to refresh the record before issuing its final response to the judgment.

The current scientific research must be immediately reviewed and acted upon in a timely manner so that the health and safety of our citizens is prioritized. Consumers must have accurate information related to the benefits and risks of the products and services available to them. Policies should be reflective of current scientific research performed in accordance with utilization. It is impossible for consumers to make educated decisions without accurate information; therefore, I am requesting that you take immediate action as directed by the courts to review the research and update any policies as necessary for the health and wellbeing of all citizens, including the most vulnerable, our children.

Sincerely,

A handwritten signature in black ink, appearing to read "Mark Gordon".

Mark Gordon
Governor of Wyoming

MG:jd:kh

Albert M. Manville, II, Ph.D., C.W.B.
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Mr. Eric V. Rickerson, State Supervisor
Washington Fish and Wildlife Office
U.S. Fish and Wildlife Service
510 Desmond Dr. SE, Suite 102
Lacey, WA 98503
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October 16, 2017

[DHH FWS Concurrence Response-AMM Final.docx]

Re: Response on behalf of Dungeness Heights Homeowners (“DHH”) to September 21, 2017, Concurrence Letter 01EWF00-2017-I-1104 (“FWS Concurrence Letter”) from the Washington Fish and Wildlife Office to Dr. Joelle Gehring, Competition and Infrastructure Policy Division, Federal Communications Commission (FCC), pertaining to the Radio Pacific, Inc., cellular and KZQM FM communications tower near Sequim, WA

Dear Supervisor Rickerson:

As you may recall, I was the U.S. Fish and Wildlife Service’s (hereafter FWS or Service) national, agency lead on all things structural that impacted migratory birds, including collisions with communication towers and impacts from the tower radiation on migratory birds and other wildlife. I served in that capacity as agency lead from 1997 to 2014, when I retired from the Service. In 2000 I co-authored the then first version of the *Interim Voluntary Communication Tower Guidelines*, which I revised and authored in 2013 (cited on page 1, paragraph 3 of your letter). Those 2013 guidelines were shared with Dr. Joelle Gehring of the FCC based on the then best available science, and they were shared with industry, individual communication tower companies, the public, and Federal and State authorities, among others. In my role as agency lead, I served: as project officer for 2 tower research lighting/height/guy wire studies performed by Dr. Gehring as the Principal Investigator before she was hired by FCC; as a colleague beginning in 2000 working with Dr. T. Litovitz and his team at Catholic University on impacts of extremely low levels of cell phone radiation on chicken embryos; as a colleague working with renowned radiation expert Dr. H. Lai (Emeritus, Univ. Washington) on non-thermal radiation effects; and as a colleague working with European scientists, especially Dr. A. Balmori and Dr. J. Everaert, documenting impacts of cell towers on wild nesting migratory birds. I also served as Chairman of the Communication Tower Working Group (“CTWG”) whose stakeholders included the FCC, Federal Aviation Administration, FWS, other Federal agencies, all major broadcast and cellular (cell) phone trade associations, individual companies, academicians, consultants, and conservationists, among others. The function of the CTWG was to assess, use and recommend the latest science dealing with avian impacts from tower collisions and radiation. Once retiring from Federal service, I have remained extremely active regarding tower impacts to migratory birds from collisions and radiation.

When I retired, FWS Washington DC HQ Office did not replace my position, especially those components dealing with impacts of cell and other broadcast towers on migratory birds. While that was unfortunate, it provides absolutely no excuse to FWS for failing to recognize and failing to continue to address growing impacts from collisions and radiation on migratory birds. I have documented those scientific issues in considerable published detail in a number of peer-reviewed and refereed papers both while

working for FWS and more recently as a consultant, as previously referenced in our Dungeness Heights Homeowners (DHH) filings to FWS and FCC.

The FCC Staff possibly will rely on this FWS Concurrence Letter as the principal basis for no further requirement for any NEPA review. This is scientifically and legally indefensible, fails to address the many points DHH raised in previous submissions, and does not preclude the need for further NEPA review. Specific concerns include the following:

- This FWS Concurrence Letter is cursory at best, misleading, incorrect in one specific study interpretation, and completely fails to represent most of the ongoing scientific developments as we know and understand them today especially regarding impacts to migratory birds. For example, in your reference to the *2013 USFWS Revised Voluntary Guidelines* (which as the principal author I am quite familiar), you mention that the proposed Radio Pacific tower will be a 150-ft [AGL] tall monopole. This design does indeed follow recommended FWS best practices — i.e., unguyed and unlit. However, what is **not** addressed are the likely impacts to Bald Eagles, and other nesting and roosting migratory birds, of the proposed “faux” fiberglass fir tree branches — possibly causing impalement on the sharp fiberglass branches, injury and death to birds which attempt to both use or avoid them at the last minute, not to mention impacts from both thermal and non-thermal radiation from the antennas. Bald Eagles tend to use the tallest objects available for roosting, and roosting will likely occur on the “faux” fiberglass branches since the antennas will extend more than 60 ft above the current tree line. A NEPA review, ideally through a nationwide EIS (or the very least an EA) is strongly recommended. DHH previously raised these collision, impalement and radiation likely environmental impacts to migratory birds and especially to the locally important Bald Eagle population to FWS and FCC before. These issues were brought to the attention of FCC in: DHH 3-17-16 Request for Environmental Review Brief and Appendices; DHH 4-6-16 Reply and Appendices; DHH 4-27-16 Opposition which includes the 4-25-16 Manville Declaration, all in FCC File No. A0985196. Similar documents are filed in FCC File No. BMPH-20150922ACS. The FWS was provided with the relevant materials in those FCC files, plus with additional materials, all emailed in a series of 12 emails first sent on 7-28-16 to Mark Miller of the Washington Fish and Wildlife Office (along with hand delivery of a paper copy) and sent again on 6-19-17 by forwarding the same series of 12 emails to Michael Green and Emily Teachout of the FWS. The FWS Concurrence Letter is an inadequate response to the best available science provided by DHH.
- There are numerous other issues in the *2013 USFWS Revised Voluntary Guidelines* which DHH raised — e.g., build towers in degraded habitats, avoid citing towers near wetlands (several in the immediate area), and implement at least 1-mi minimum distance buffers between active Bald Eagle nests and towers based on previous FWS scientific studies in Wyoming (FWS Portland Office instead argued for a 600-ft Eagle buffer and only during construction of the tower although there currently are several active nests within 1 mile of the proposed tower site — the 600 ft buffer is **not** recommended in the *2013 Guidelines*). Absolutely no mention was made about concerns from the pulsed radio waves that will extend, line-of-sight blanketing the area, from the FM radio antennas affecting especially Bald Eagles and humans. Additionally, no mention is made of the power levels for FM transmission (6,000 Watts for this commercial station), far higher than the UHF antennas, exacerbating effects of thermal heating. Further, no mention is made of thermal heating effects from the FM antenna which will be coupled with the UHFs from the proposed cellular antennas. As we previously stated, this creates a very dangerous frequency potential for Bald Eagles since the length of the FM signal is about 6 ft, creating a full-body resonant effect for both humans and Bald Eagles (wingspans also about 6 ft). The FWS Concurrence Letter does not address these issues.
- Under the Section titled Migratory Birds and Bald Eagles (p. 3 of the FWS Concurrence Letter), FWS mentions precluding “take” under MBTA, “*unless authorized by permit*” but concludes in this paragraph that “*there is no permit available for incidental take.*” However, FWS does acknowledge that

permits for “take of Bald Eagles” are available under 50 CFR 22.26 (“take resulting in mortality” and “take resulting in disturbance”), but fails to mention that the permit process sets allowable levels of take over a certain time period and permit applications are open to public NEPA review and comment. These details were not included in FWS Concurrence Letter failing to provide full disclosure about the facts.

- In the FWS Concurrence Letter on p. 4 (opening paragraph), FWS indicates that “*we reviewed the information supplied by Albert Manville regarding the potential effects to these species from construction of this tower and conclude that negative effects are unlikely.*” Upon what rationale, scientific information, studies and published papers is this conclusion reached? We provided detailed studies on the record quite to the contrary. FWS then states that “*the collision risk by this tower to swans, eagles, and other species, is remote because the proposed tower is a monopole design, precluding need for guy wires.*” Sadly, FWS has cherry-picked here, using only a small portion of the 2013 Guidelines to reach what we feel is a flawed conclusion. Surrounding freshwater wetlands will attract myriad species of migratory birds. Swans have already been documented to fly directly over the proposed tower site. Bald Eagles have been photo-documented using the trees both on and next to the proposed tower site as a roost. (See Manville Report (App. R) Attachments R1 to R3) The tower is to be placed on a hill where the effects of fog, inclement weather, and storms may enhance collision mortality, especially impalement on the “faux” branches. The “noise effect” (Engels et al. 2014, referenced in my Manville 2016 radiation briefing memo provided to FWS) has been documented and shows that migratory birds are unable to use their magnetic compass in the presence of urban electromagnetic noise during movement and migration. How will enhanced microwave and FM signals exacerbate this “noise” effect? This issue was simply not addressed.
- FWS did leave open the door to further NEPA review. “*The body of science examining the effects of radiation emitted by communication towers on animals is growing, and developmental effects on bird embryos have been noted in some lab studies under **high** [note: they actually were conducted under incredibly **low doses** of 0.0001 the amounts of radiation normally emitted from the standard 900 HZ cell phone over 2 hour daily periods] doses; additional studies are needed to evaluate the effects of this radiation on birds in controlled situations in the field, mimicking levels of radiation typically used by industry.*” To clarify, these low dose studies were intended to assess impacts from very low levels of non-thermal non-ionizing radiation. As I stated in my 2016 radiation briefing memo (Manville 2016; “A Briefing Memorandum: What We Know, Can Infer, and Don’t Yet Know about Impacts from Thermal and Non-thermal Non-ionizing Radiation on Birds and Other Wildlife — for Public Release,” 12 pp peer-reviewed), **thermal effects** are generally pretty clear and already have been well documented.
- The FWS Concurrence Letter does not foreclose the need for further NEPA review. For example, 2 of the factors in the implementing regulations for NEPA help determine whether an impact is sufficiently significant to necessitate an EIS (or at least an EA). One includes “*the degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risk.*” The other concludes “*the degree to which the effects on the quality of the human environment are likely to be highly controversial*” (40 CFR 1508.27(b)(4) and (5)). The FWS Concurrence Letter essentially concedes (p. 4) that the impacts to Bald Eagles and other birds from radiation emitted from the tower are at least “*highly uncertain*” and entail “*unknown risks.*” Effects are “*highly controversial*” under NEPA when there is a “*substantial dispute*” regarding the nature and extent of the impact. (*Middle Rio Grande Conservancy Dist v Norton*, 294 F.3d 1220, 1229 (10th Cir. 2002)) Clearly a **scientific dispute** which I have raised as has been acknowledged by FWS has been held to be the clearest example of when such controversy exists for purposes of NEPA. The fact that I was invited as the Service’s lead scientist on the collision and radiation issues to provide Enclosure A (Background, and Discussion on Collision Deaths and Categorical Exclusions, and Discussion on Radiation Impacts and Categorical Ex-

clusion) to the letter sent to the National Telecommunications and Information Administration, U.S. Department of Commerce, is telling. The letter (previously provided for the record) was signed on February 7, 2014, by the then Director, Office of Environmental Policy and Compliance, Department of Interior (letters ER 14/0001, ER 14/0004) recommending that NTIA not categorically exclude impacts from non-thermal radiation on migratory birds, and clearly acknowledges that FWS and DOI have already acknowledged the need to address impacts on non-thermal radiation on migratory birds under NEPA.

We respectfully request that FWS re-evaluate its position on NEPA and request that FCC conduct an EIS (or at least an EA) to begin addressing these very troubling issues regarding impacts from radiation and collisions on migratory birds. Respectfully submitted.

Albert M. Manville, II, Ph.D., C.W.B.
Principal, Wildlife and Habitat Conservation Solutions, LLC
Adjunct Professor, Advanced Academic Programs, Krieger School of Arts and Sciences, Johns Hopkins Univ., DC Campus



United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

FEB - 7 2014



In Reply Refer To: (ER 14/0001) (ER 14/0004).

Mr. Eli Veenendaal
National Telecommunications and Information
Administration
U.S. Department of Commerce
1401 Constitution Avenue, N.W.
Washington, D.C. 20230

Dear Mr. Veenendaal:

The Department of the Interior (Department) has reviewed the above referenced proposal and submits the following comments and attachment for consideration. Because the First Responder Network Authority (FirstNet) is a newly created entity, we commend the U.S. Department of Commerce for its timely proposals for NEPA implementing procedures.

The Department believes that some of the proposed procedures are not consistent with Executive Order 13186 Responsibilities of Federal Agencies to Protect Migratory Birds, which specifically requires federal agencies to develop and use principles, standards, and practices that will lessen the amount of unintentional take reasonably attributed to agency actions. The Department, through the Fish and Wildlife Service (FWS), finds that the proposals lack provisions necessary to conserve migratory bird resources, including eagles. The proposals also do not reflect current information regarding the effects of communication towers to birds. Our comments are intended to further clarify specific issues and address provisions in the proposals.

The Department recommends revisions to the proposed procedures to better reflect the impacts to resources under our jurisdiction from communication towers. The placement and operation of communication towers, including un-guyed, unlit, monopole or lattice-designed structures, impact protected migratory birds in two significant ways. The first is by injury, crippling loss, and death from collisions with towers and their supporting guy-wire infrastructure, where present. The second significant issue associated with communication towers involves impacts from non-ionizing electromagnetic radiation emitted by them (See Attachment).

In addition to the 147 Birds of Conservation Concern (BCC) species, the FWS has listed an additional 92 species as endangered or threatened under the Endangered Species Act. Together with the bald and golden eagle, this represents 241 species of birds whose populations are in trouble or otherwise merit special protection, according to the varying criteria of these lists. The Department suggests that FirstNet consider preparing a programmatic environmental impact statement (see attachment) to determine and address cumulative impacts from authorizing FirstNet projects on those 241 species for which the incremental impact of tower mortality, when

added to other past, present, and reasonably foreseeable future actions, is most likely significant, given their overall imperiled status. Notwithstanding the proposed implementing procedures, a programmatic NEPA document might be the most effective and efficient method for establishing best management practices for individual projects, reducing the burden to individual applicants, and addressing cumulative impacts.

Categorical Exclusions

The Department has identified 13 of the proposed categorical exclusions (A-6, A-7, A-8, A-9, A-10, A-11, A-12, A-13, A-14 A-15, A-16, A-17, and A-19) as having the potential to significantly affect wildlife and the biological environment. Given this potential, we want to underscore the importance of our comments on FirstNet's procedural guidance under Environmental Review and Consultation Requirements for NEPA Reviews and its list of extraordinary circumstances in Appendix D.

Environmental Review and Consultation Requirements for NEPA Reviews

To ensure there are no potentially significant impacts on birds from projects that may otherwise be categorically excluded, the Department recommends including the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act to the list of requirements in this section.

Extraordinary Circumstances

To avoid potentially significant impacts on birds from projects that may otherwise be categorically excluded, the Department recommends including species covered under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act to the list of environmentally sensitive resources. Additionally, adding important resources to migratory birds such as sites in the Western Hemisphere Shorebird Reserve Network and Audubon Important Bird Areas to the paragraph on areas having special designation or recognition would help ensure their consideration when contemplating use of a categorical exclusion.

Developing the Purpose and Need

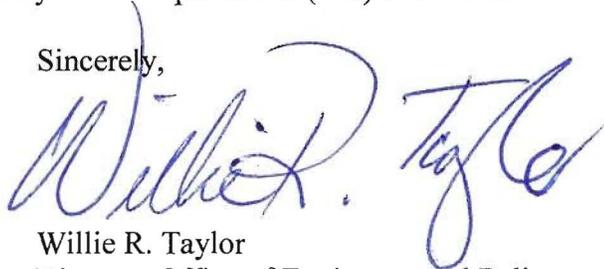
The Department recommends inclusion of language that would ensure consideration of all other authorities to which NEPA is supplemental as opposed to simply the FirstNet mission. As currently written, the procedures are limited to ensuring the purpose and need considers the FirstNet mission. If strictly applied, this approach would severely limit the range of reasonable alternatives, and likely preclude consideration of more environmentally benign locations or construction practices.

Environmental Review Process, Apply NEPA Early in the Process, Where Action is by Non-Federal Entity

The Department recommends that FirstNet be required to coordinate with federal agencies having jurisdiction by law or special expertise on construction and lighting of its network of towers.

Thank you for the opportunity to comment on the draft document. If you have any questions concerning the comments, please contact Diana Whittington, NEPA Migratory Bird lead, at (703) 358-2010. If you have any questions regarding Departmental NEPA procedures, contact Lisa Treichel, Office of Environmental Policy and Compliance at (202) 208-7116.

Sincerely,

A handwritten signature in blue ink, appearing to read "Willie R. Taylor". The signature is fluid and cursive, with the first name "Willie" being the most prominent.

Willie R. Taylor
Director, Office of Environmental Policy
and Compliance

Enclosure

Literature Cited

- Longcore, T., C. Rich, P. Mineau, B. MacDonald, D.G. Bert, L.M. Sullivan, E. Mutrie, S.A. Gauthreaux, Jr., M.L. Avery, R.C. Crawford, A.M. Manville, II, E.R. Travis, and D. Drake. 2013. Avian mortality at communication towers in the United States and Canada: which species, how many, and where? *Biological Conservation* 158: 410-419.
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Enclosure A

Background

The placement and operation of communication towers, including un-guyed, unlit, monopole or lattice-designed structures, impact protected migratory birds in two significant ways.

The first is by injury, crippling loss, and death from collisions with towers and their supporting guy-wire infrastructure, where present. Mass mortality events tend to occur during periods of peak spring and fall songbird migration when inclement weather events coincide with migration, and frequently where lights (either on the towers and/or on adjacent outbuildings) are also present. This situation has been well documented in the U.S. since 1948 in the published literature (Aronoff 1949, see Manville 2007a for a critique). The tallest communication towers tend to be the most problematic (Gehring *et al.* 2011). However, mid-range (~400-ft) towers as proposed by the First Responder Network Authority (FirstNet, a newly created entity under the Department of Commerce) can also significantly impact protected migratory birds, as can un-guyed and unlit lattice and monopole towers (Gehring *et al.* 2009, Manville 2007a, 2009, 2013a). Mass mortalities (more than several hundred birds per night) at un-guyed, unlit monopole and lattice towers were documented in fall 2005 and 2011 in the Northeast and North Central U.S. (*e.g.*, Manville 2007a). It has been argued that communication towers including “short” towers do not impact migratory birds, including at the population level (*e.g.*, Arnold and Zink 2011), but recent findings have contradicted that assertion (Manville 2007a, 2013a, Longcore *et al.* 2012, 2013).

The second significant issue associated with communication towers involves impacts from non-ionizing electromagnetic radiation emitted by these structures. Radiation studies at cellular communication towers were begun circa 2000 in Europe and continue today on wild nesting birds. Study results have documented nest and site abandonment, plumage deterioration, locomotion problems, reduced survivorship, and death (*e.g.*, Balmori 2005, Balmori and Hallberg 2007, and Everaert and Bauwens 2007). Nesting migratory birds and their offspring have apparently been affected by the radiation from cellular phone towers in the 900 and 1800 MHz frequency ranges – 915 MHz is the standard cellular phone frequency used in the United States. However, the electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today. This is primarily due to the lower levels of radiation output from microwave-powered communication devices such as cellular telephones and other sources of point-to-point communications; levels typically lower than from microwave ovens. The problem, however, appears to focus on very low levels of non-ionizing electromagnetic radiation. For example, in laboratory studies, T. Litovitz (personal communication) and DiCarlo *et al.* (2002) raised concerns about impacts of low-level, non-thermal electromagnetic radiation from the standard 915 MHz cell phone frequency on domestic chicken embryos – with some lethal results (Manville 2009, 2013a). Radiation at extremely low levels (0.0001 the level emitted by the average digital cellular telephone) caused heart attacks and the deaths of some chicken embryos subjected to hypoxic conditions in the laboratory while controls subjected to hypoxia were unaffected (DiCarlo *et al.* 2002). To date, no independent, third-party field studies have been conducted in North America on impacts of tower electromagnetic radiation on migratory birds. With the European field and U.S. laboratory evidence already available,

independent, third-party peer-reviewed studies need to be conducted in the U.S. to begin examining the effects from radiation on migratory birds and other trust species.

Discussion

Collision Deaths and Categorical Exclusions

Attempts to estimate bird-collision mortality at communication towers in the U.S. resulted in figures of 4-5 million bird deaths per year (Manville 2005, 2009). A meta-review of the published literature now suggests, based on statistically determined parameters, that mortality may be 6.8 million birds per year in Canada and the U.S.; the vast majority in the United States (Longcore *et al.* 2012). Up to 350 species of birds have been killed at communication towers (Manville 2007a, 2009). The Service's Division of Migratory Bird Management has updated its voluntary, 2000 communication tower guidelines to reflect some of the more recent research findings (Manville 2013b). However, the level of estimated mortality alone suggests at a minimum that FirstNet prepare an environmental assessment to estimate and assess the cumulative effects of tower mortality to protected migratory birds.

A second meta-review of the published mortality data from scientific studies conducted in the U.S. and Canada (Longcore *et al.* 2013) strongly correlates population effects to at least 13 species of Birds of Conservation Concern (BCC, USFWS 2008). These are mortalities to BCC species based solely on documented collisions with communication towers in the U.S. and Canada, ranging from estimated annual levels of mortality of 1 to 9% of their estimated total population. Among these where mortality at communication towers was estimated at over 2% annually are the Yellow Rail, Swainson's Warbler, Pied-billed Grebe, Bay-breasted Warbler, Golden-winged Warbler, Prairie Warbler, and Ovenbird. Longcore *et al.* (2013) emphasized that avian mortality associated with anthropogenic sources is almost always reported in the aggregate, *i.e.*, "number of birds killed," which cannot detect species-level effects necessary to make effective and meaningful conservation assessments, including determining cumulative effects. These new findings strongly suggest the need for at least an environmental assessment by FirstNet, or more likely, an environmental impact statement.

Radiation Impacts and Categorical Exclusions

There is a growing level of anecdotal evidence linking effects of non-thermal, non-ionizing electromagnetic radiation from communication towers on nesting and roosting wild birds and other wildlife in the U.S. Independent, third-party studies have yet to be conducted in the U.S. or Canada, although a peer-reviewed research protocol developed for the U.S. Forest Service by the Service's Division of Migratory Bird Management is available to study both collision and radiation impacts (Manville 2002).

As previously mentioned, Balmori (2005) found strong negative correlations between levels of tower-emitted microwave radiation and bird breeding, nesting, and roosting in the vicinity of electromagnetic fields in Spain. He documented nest and site abandonment, plumage deterioration, locomotion problems, reduced survivorship, and death in House Sparrows, White Storks, Rock Doves, Magpies, Collared Doves, and other species. Though these species had historically been documented to roost and nest in these areas, Balmori (2005) did not observe these symptoms prior to construction and operation of the cellular phone towers. Balmori and Hallberg (2007) and Everaert and Bauwens (2007) found similar strong negative correlations

among male House Sparrows. Under laboratory conditions, DiCarlo *et al.* (2002) raised troubling concerns about impacts of low-level, non-thermal electromagnetic radiation from the standard 915 MHz cell phone frequency on domestic chicken embryos – with some lethal results (Manville 2009). Given the findings of the studies mentioned above, field studies should be conducted in North America to validate potential impacts of communication tower radiation – both direct and indirect – to migratory birds and other trust wildlife species.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MAR 8 2002

OFFICE OF
AIR AND RADIATION

Janet Newton
President
The EMR Network
P.O. Box 221
Marshfield, VT 05658

Dear Ms. Newton:

Thank you for your letter of January 31, 2002, to the Environmental Protection Agency Administrator Whitman, in which you express your concerns about non-thermal effects of radiofrequency (RF) radiation and the adequacy of the Federal Communications Commission's RF radiation exposure guidelines. The Administrator has asked us to critically examine the issues you bring to our attention, and we will be responding to you shortly.

We appreciate your interest in the matter of non-thermal RF exposure, possible health risks, and Federal government responsibility to protect human health.

Sincerely,

A handwritten signature in cursive script, appearing to read "Frank Marcynowski".

Frank Marcynowski, Director
Radiation Protection Division



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JUL 16 2002

OFFICE OF
AIR AND RADIATION

Ms. Janet Newton
President
The EMR Network
P.O. Box 221
Marshfield, VT 05658

Dear Ms. Newton:

This is in reply to your letter of January 31, 2002, to the Environmental Protection Agency (EPA) Administrator Whitman, in which you express your concerns about the adequacy of the Federal Communications Commission's (FCC) radiofrequency (RF) radiation exposure guidelines and nonthermal effects of radiofrequency radiation. Another issue that you raise in your letter is the FCC's claim that EPA shares responsibility for recommending RF radiation protection guidelines to the FCC. I hope that my reply will clarify EPA's position with regard to these concerns. I believe that it is correct to say that there is uncertainty about whether or not current guidelines adequately treat nonthermal, prolonged exposures (exposures that may continue on an intermittent basis for many years). The explanation that follows is basically a summary of statements that have been made in other EPA documents and correspondence.

The guidelines currently used by the FCC were adopted by the FCC in 1996. The guidelines were recommended by EPA, with certain reservations, in a letter to Thomas P. Stanley, Chief Engineer, Office of Engineering and Technology, Federal Communications Commission, November 9, 1993, in response to the FCC's request for comments on their Notice of Proposed Rulemaking (NPRM), Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation (enclosed).

The FCC's current exposure guidelines, as well as those of the Institute of Electrical and Electronics Engineers (IEEE) and the International Commission on Non-ionizing Radiation Protection, are thermally based, and do not apply to chronic, nonthermal exposure situations. They are believed to protect against injury that may be caused by acute exposures that result in tissue heating or electric shock and burn. The hazard level (for frequencies generally at or greater than 3 MHz) is based on a specific absorption dose-rate, SAR, associated with an effect

that results from an increase in body temperature. The FCC's exposure guideline is considered protective of effects arising from a thermal mechanism but not from all possible mechanisms. Therefore, the generalization by many that the guidelines protect human beings from harm by any or all mechanisms is not justified.

These guidelines are based on findings of an adverse effect level of 4 watts per kilogram (W/kg) body weight. This SAR was observed in laboratory research involving acute exposures that elevated the body temperature of animals, including nonhuman primates. The exposure guidelines did not consider information that addresses nonthermal, prolonged exposures, i.e., from research showing effects with implications for possible adversity in situations involving chronic/prolonged, low-level (nonthermal) exposures. Relatively few chronic, low-level exposure studies of laboratory animals and epidemiological studies of human populations have been reported and the majority of these studies do not show obvious adverse health effects. However, there are reports that suggest that potentially adverse health effects, such as cancer, may occur. Since EPA's comments were submitted to the FCC in 1993, the number of studies reporting effects associated with both acute and chronic low-level exposure to RF radiation has increased.

While there is general, although not unanimous, agreement that the database on low-level, long-term exposures is not sufficient to provide a basis for standards development, some contemporary guidelines state explicitly that their adverse-effect level is based on an increase in body temperature and do not claim that the exposure limits protect against both thermal and nonthermal effects. The FCC does not claim that their exposure guidelines provide protection for exposures to which the 4 W/kg SAR basis does not apply, i.e., exposures below the 4 W/kg threshold level that are chronic/prolonged and nonthermal. However, exposures that comply with the FCC's guidelines generally have been represented as "safe" by many of the RF system operators and service providers who must comply with them, even though there is uncertainty about possible risk from nonthermal, intermittent exposures that may continue for years.

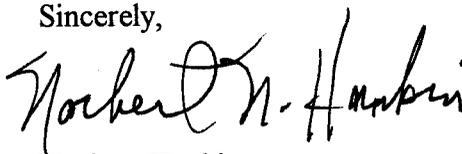
The 4 W/kg SAR, a whole-body average, time-average dose-rate, is used to derive dose-rate and exposure limits for situations involving RF radiation exposure of a person's entire body from a relatively remote radiating source. Most people's greatest exposures result from the use of personal communications devices that expose the head. In summary, the current exposure guidelines used by the FCC are based on the effects resulting from whole-body heating, not exposure of and effect on critical organs including the brain and the eyes. In addition, the maximum permitted local SAR limit of 1.6 W/kg for critical organs of the body is related directly to the permitted whole body average SAR (0.08 W/kg), with no explanation given other than to limit heating.

I also have enclosed a letter written in June of 1999 to Mr. Richard Tell, Chair, IEEE SCC28 (SC4) Risk Assessment Work Group, in which the members of the Radiofrequency Interagency Work Group (RFIAWG) identified certain issues that they had determined needed to be addressed in order to provide a strong and credible rationale to support RF exposure guidelines.

Federal health and safety agencies have not yet developed policies concerning possible risk from long-term, nonthermal exposures. When developing exposure standards for other physical agents such as toxic substances, health risk uncertainties, with emphasis given to sensitive populations, are often considered. Incorporating information on exposure scenarios involving repeated short duration/nonthermal exposures that may continue over very long periods of time (years), with an exposed population that includes children, the elderly, and people with various debilitating physical and medical conditions, could be beneficial in delineating appropriate protective exposure guidelines.

I appreciate the opportunity to be of service and trust that the information provided is helpful. If you have further questions, my phone number is (202) 564-9235 and e-mail address is hankin.norbert@epa.gov.

Sincerely,



Norbert Hankin
Center for Science and Risk Assessment
Radiation Protection Division

Enclosures:

- 1) letter to Thomas P. Stanley, Chief Engineer, Office of Engineering and Technology, Federal Communications Commission, November 9, 1993, in response to the FCC's request for comments on their Notice of Proposed Rulemaking (NPRM), Guidelines for Evaluating the Environmental Effects of Radiofrequency Radiation
- 2) June 1999 letter to Mr. Richard Tell, Chair, IEEE SCC28 (SC4) Risk Assessment Work Group from the Radiofrequency Radiation Interagency Work Group

THE FCC KEEPS LETTING ME BE: WHY
RADIOFREQUENCY RADIATION STANDARDS
HAVE FAILED TO KEEP UP WITH
TECHNOLOGY

Hala Mouzaffar

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THE FCC KEEPS LETTING ME BE: WHY RADIOFREQUENCY RADIATION STANDARDS HAVE FAILED TO KEEP UP WITH TECHNOLOGY

Hala Mouzaffar*

Are you reading this on a computer? A tablet? A cellphone? Is the device using WiFi? Perhaps you have music playing through a wireless headset? Where is your cellphone right now? Is it on you? Do you carry it in your pocket all day? On a clip on your belt? How often do you have it on the table next to you? When is the last time you picked it up? Did you just reach for it? Did you think about it? Did you fall asleep last night with it next to you? Do you use it as an alarm in the morning? When is the last time you did not have it next to you? In the same room as you?

If you have any difficulty remembering the last time you were not within inches of an electronic device, you are not alone. Since the inception of wireless communication, devices of increasing technological advancement have become ingrained into the fabric of society. Wireless devices have become an extension of the human body and an integral part of everyday life for a majority of Americans and the world in general.

Regardless of whether the wireless device makes a call, sends a text, searches the internet, or shares a stream, within a moment's notice of the user initiating a

* Hala received her J.D. from the University of Pittsburgh School of Law in 2021, and has not gotten a good night's sleep since the late 90s. She would like to thank herself for typing this, herself for editing this, and herself for finishing this. Without her, this Note would not have been possible. She would like to give a special thanks to her family for listening to her talk about the Note incessantly and still willingly agreeing to read it.

command, the command transforms into a digital or electrical signal.¹ The signal is then transmitted via electromagnetic waves from the device to its corresponding destination.² The corresponding destination depends on the command issued, which can be to a cell tower or another wireless device.³ A return signal is transmitted back to the user's device in the same fashion.⁴ This transmission of signals between locations continues until the command ends.⁵ Wireless communication devices utilize a specific subcategory of electromagnetic waves, known as radiofrequency ("RF") waves.⁶ RF wave signals emitted from wireless devices are known as radiofrequency radiation ("RFR").⁷

As of 2018, an estimated five billion people worldwide have cellphones.⁸ As of 2020, Americans averaged 5.4 hours of active usage daily.⁹ When users are actively using their phone, their device is continuously emitting RFR.¹⁰ While it is somewhat frightening to imagine that the average user is being exposed to radiation for 5.4 hours a day, in actuality, the phone continues to emit the same levels of RFR for the

¹ Chris Woodford, *How Cellphones Work*, EXPLAIN THAT STUFF (July 19, 2020), <https://www.explainthatstuff.com/cellphones.html>; Lesics, *How Does Your Mobile Phone Work? | ICT #1*, YOUTUBE (Dec. 29, 2018), https://www.youtube.com/watch?v=1JZG9x_VOwA [<https://perma.cc/P22N-HTPE>].

² Woodford, *supra* note 1.

³ *Id.*

⁴ *Cellular (Cell) Phones*, AM. CANCER SOC'Y (June 1, 2020), <https://www.cancer.org/cancer/cancer-causes/radiation-exposure/cellular-phones.html> [<https://perma.cc/75F6-Y8WL>].

⁵ Woodford, *supra* note 1.

⁶ *Cellular (Cell) Phones*, *supra* note 4.

⁷ *Id.*

⁸ Laura Silver, *Smartphone Ownership Is Growing Rapidly Around the World, but Not Always Equally*, PEW RSCH. CTR. (Feb. 5, 2019), <https://www.pewresearch.org/global/2019/02/05/smartphone-ownership-is-growing-rapidly-around-the-world-but-not-always-equally/> [<https://perma.cc/HWK9-ZE9D>].

⁹ Eileen Brown, *Americans Spend Far More Time on Their Smartphones Than They Think*, ZDNET (Apr. 28, 2019), <https://www.zdnet.com/article/americans-spend-far-more-time-on-their-smartphones-than-they-think/> [<https://perma.cc/B6EM-SWKM>].

¹⁰ Simon Chandler, *How to Reduce Exposure to Cell Phone Radiation*, DIGITAL TRENDS (Mar. 26, 2021), <https://www.digitaltrends.com/mobile/reduce-exposure-cell-phone-radiation/> [<https://perma.cc/E82Y-SJ3R>]; *How to Reduce Exposure to Radiofrequency Energy from Cell Phones*, CAL. DEP'T OF PUB. HEALTH, DIV. OF ENV'T & OCCUPATIONAL DISEASE CONTROL, <https://www.cdph.ca.gov/Programs/CCDC/DEOD/CEID/CDPH%20Document%20Library/Cell-Phone-Guidance.pdf> [<https://perma.cc/5P82-U6DS>].

remaining 18.6 hours of the day unless the device is turned completely off;¹¹ wireless devices only cease producing RFR when they are completely turned off—not in standby mode with the screen locked.¹² A 2013 study found that 79% of people ages 18–44 have their phones on or are near their person for 22 hours a day.¹³ Accordingly, the majority of wireless communication device users experience constant, around-the-clock RFR exposure.

Scientists have been researching the effects of RFR since the inception of these devices. Although still not perfect, laboratory techniques have become increasingly sophisticated, and researchers have been better able to isolate and draw conclusions on the effects of RFF on the human body. While methods are not foolproof and debate still exists, data suggests that prolonged RFR exposure can potentially have detrimental health effects.¹⁴

There are two government agencies that primarily retain the regulatory authority over wireless communications devices: the Federal Communications Commission (“FCC”) and the Food and Drug Administration (“FDA”).¹⁵ In this coupled regulatory structure, the FCC sets the guidelines and certifies that manufacturers comply with them.¹⁶ With wireless devices being so commonplace, it is surprising to know that the FCC has been adamant since the beginning that they do not have the expertise to set standards; instead, they insist on referring to their stance as simply *guidelines*.¹⁷ The FDA serves more of an oversight role; they collect and provide scientific data regarding RFR and consult with other federal agencies on testing and evaluating RFR.¹⁸ The FDA can also interfere and take action if they have

¹¹ See Chandler, *supra* note 10.

¹² *Id.*

¹³ Allison Stadd, *79% of People 18–44 Have Their Smartphones With Them 22 Hours a Day [STUDY]*, ADWEEK (Apr. 2, 2013), <https://www.adweek.com/digital/smartphones/> [<https://perma.cc/CQ9N-RW32>].

¹⁴ Zahid Naeem, *Health Risks Associated with Mobile Phones Use*, 8 INT’L J. HEALTH SCIS. 5, 5 (2014), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4350886/> [<https://perma.cc/QA9Y-32F4>].

¹⁵ *Cell Phones*, U.S. FOOD & DRUG ADMIN. (May 13, 2021), <https://www.fda.gov/radiation-emitting-products/home-business-and-entertainment-products/cell-phones> [<https://perma.cc/87US-A74X>].

¹⁶ *Id.*

¹⁷ See Carol R. Goforth, *A Bad Call: Preemption of State and Local Authority to Regulate Wireless Communication Facilities on the Basis of Radiofrequency Emissions*, 44 N.Y.L. SCH. L. REV. 311, 360 (2001).

¹⁸ *Id.*

evidence that a particular wireless communication device emits an amount of RFR that is hazardous to the user.¹⁹ Despite the growing body of scientific evidence, and their paired authority to take action, these two agencies have refrained from acknowledging any adverse health effects; instead, they issue *guidelines* for companies to follow—those of which were last updated in 1996.²⁰

With each passing year, scientists and researchers continue to find connections between wireless devices and deleterious health effects.²¹ The vast majority of current research only measures health impacts for a limited amount of time.²² Because these products are relatively new, no research exists on their effects over the course of a person's lifetime. There is no telling what thirty, forty, or even fifty years of constant exposure could do. With cellphones physically in the hands of nearly 97% of Americans,²³ if guidelines remain at their current levels, and long-term usage of such devices proves to be as detrimental as current research suggests, wireless devices have the potential to cause one of the largest national public health threats the United States has ever seen.

Part I of this Note will provide a basic understanding of the science behind RFR and the current scientific research on how it physically impacts biological systems. Part II will look at the history of RFR regulation in the U.S. and how the FCC and FDA gained their respective roles within the regulatory framework. Finally, Part III will look to the future of wireless communication technology and explore possible solutions and pathways that the government can take to mitigate the potential health risk.

¹⁹ *Wireless Devices and Health Concerns*, FED. COMM'N COMM'N (Nov. 4, 2020), <https://www.fcc.gov/consumers/guides/wireless-devices-and-health-concerns> [<https://perma.cc/RFF9-BCF6>]. The FDA and FCC belong to the Radiofrequency Interagency Work Group, a group of six different federal agencies that review and coordinate with each other on different aspects of RF safety. The group also includes the National Institute for Occupation Safety and Health, the Environmental Protection Agency, and the Occupation Safety and Health Administration. *Id.*

²⁰ Kenneth A. Jacobsen, *A Tale of Two Circuits: Curbs on Legal Remedies for Exposure to Potentially Harmful Cell Phone Radiation*, 10 SETON HALL CIR. REV. 1, 13 (2013).

²¹ See FDA, REVIEW OF PUBLISHED LITERATURE BETWEEN 2008 AND 2018 OF RELEVANCE TO RADIOFREQUENCY RADIATION AND CANCER (2020), <https://www.fda.gov/media/135043/download> [<https://perma.cc/UN68-M4ZC>].

²² *Wireless Devices and Health Concerns*, *supra* note 19.

²³ *Mobile Fact Sheet*, PEW RSCH. CTR. (Apr. 7, 2021), <https://www.pewresearch.org/internet/fact-sheet/mobile/> [<https://perma.cc/HD62-RDS4>].

I. A CELLULAR UNDERSTANDING

“It is well established that exposure to high levels of RFR can cause adverse health effects.”²⁴ These dangers and risks are backed by science and appropriately reflected in safety standards for jobs with high RFR exposure—like for employees working in broadcasting transport and communication industries that work in close proximity to transmitting antennas and radar systems.²⁵ However, it is important to be candid that there is no consensus within the scientific community as to how RFR produced by wireless communication devices affects the human body.²⁶ For every animal or epidemiological study that points to potentially dangerous health effects, there is another that concludes the opposite.²⁷ Part of the reason for such vast inconsistencies in research in this area is that even with top-of-the-line technology, it is still difficult to control and maintain a consistent level of RFR.²⁸ Despite these limitations, “since the early 1960s, researchers have published hundreds of peer reviewed studies that, individually and collectively, raise serious and credible questions regarding RFR [produced by] cell phones and the potential health threat it poses to cell phone users.”²⁹

Nearly every device that communicates via a wireless connection in at least some capacity utilizes RFR—be it cellphones, computers, wireless headsets, televisions, or the radio.³⁰ The exact frequency the device uses varies depending on the product.³¹ For example, cellphones typically fall in the “Ultra High Frequency”

²⁴ *Pinney v. Nokia, Inc.*, 402 F.3d 430, 440 (4th Cir. 2005).

²⁵ *Radiofrequency Radiation*, AUSTL. RADIATION PROT. & NUCLEAR SAFETY AGENCY, <https://www.arpansa.gov.au/understanding-radiation/what-is-radiation/non-ionising-radiation/radiofrequency-radiation> [<https://perma.cc/AZ7C-F8P5>]; *Radiofrequency and Microwave Radiation: Standards*, U.S. DEP'T OF LAB., <https://www.osha.gov/radiofrequency-and-microwave-radiation/standards> [<https://perma.cc/49FU-EKYR>].

²⁶ *Pinney*, 402 F.3d at 440.

²⁷ FDA, *supra* note 21.

²⁸ See generally *id.*

²⁹ Jacobsen, *supra* note 20, at 20.

³⁰ *Radiofrequency (RF) Radiation*, AM. CANCER SOC'Y (June 1, 2020), <https://www.cancer.org/cancer/cancer-causes/radiation-exposure/radiofrequency-radiation.html> [<https://perma.cc/YV9L-77KS>].

³¹ See *The Electromagnetic Spectrum*, NASA: IMAGINE THE UNIVERSE (Mar. 2013), <https://imagine.gsfc.nasa.gov/science/toolbox/emspectrum1.html> [<https://perma.cc/JD5M-3V82>].

category, which ranges from 300 MHz to 3000 MHz,³² whereas wireless headsets emit a frequency of about 2.4 GHz.³³ The specific frequency of the device also determines how deep the radiation penetrates the body.³⁴ The higher the frequency, the deeper the penetration.³⁵

Wireless devices communicate by emitting RFR between the product's antenna and the device it is communicating with, i.e., wireless headphones and a cellphone or a cellphone and a cell tower.³⁶ In older devices, the antenna was on the body and an obvious physical characteristic, but in modern devices, antennas are internal and out of plain sight.³⁷ The antenna is responsible for receiving and transmitting the signal.³⁸ Accordingly, it is the area of the device with the highest concentration of RFR emission.³⁹ The antenna exposes the part of our body that it is closest to with the highest concentration of radiation.⁴⁰ For example, when talking on the phone, RFR most directly affects the brain, and carrying a device in your pocket will have the greatest effect on the reproductive organs.⁴¹ The way RFR interacts with the body depends on a laundry list of factors: the distance of the device from the body, which

³² *Ultra High Frequency*, CHEMEUROPE.COM, https://www.chemeurope.com/en/encyclopedia/Ultra_high_frequency.html [<https://perma.cc/N9CK-HS9T>].

³³ Chief Editor, *Showdown of Wireless TV Headphones: RF vs IF vs Bluetooth*, HEADPHONESTY (Sept. 2, 2021), <https://www.headphonesty.com/2019/11/wireless-tv-headphones-radiofrequency-infrared-bluetooth/> [<https://perma.cc/B7VJ-CMJZ>].

³⁴ *What Are the Risks of Non-Ionising Radiation?*, INSTS. ORG. OF THE DUTCH RSCH. COUNCIL, <https://www.nwo-i.nl/en/employees/working-conditions/non-ionising-radiation/> [<https://perma.cc/UH92-LD37>].

³⁵ *See id.*

³⁶ Woodford, *supra* note 1; *Radiofrequency (RF) Radiation*, *supra* note 30; Mosa Moradi et al., *Effect of Ultra High Frequency Mobile Phone Radiation on Human Health*, 8 ELEC. PHYSICIAN 2452, 2453 (2016), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4930268/pdf/epj-08-2452.pdf>.

³⁷ Lou Frenzel, *Today's Antennas Tune into the Needs of Modern Wireless Devices*, ELEC. DESIGN (Mar. 14, 2011), <https://www.electronicdesign.com/technologies/communications/article/21792905/todays-antennas-tune-into-the-needs-of-modern-wireless-devices> [<https://perma.cc/GPB8-PQFY>].

³⁸ *Id.*

³⁹ *RF Safety FAQ*, FED. COMM'NS COMM'N, <https://www.fcc.gov/engineering-technology/electromagnetic-compatibility-division/radio-frequency-safety/faq/rf-safety> [<https://perma.cc/Y2RM-CBKS>].

⁴⁰ *Id.*

⁴¹ *Cellular (Cell) Phones*, *supra* note 4.

part of the body it is nearest, weight, bone density, etc.⁴² These factors all play a crucial role in determining the amount of radiation the body's cells absorb.⁴³ When radiation enters the cell, it disrupts the mechanisms of the cell.⁴⁴ Once absorbed, the RFR can: cause the cell to suffer enough damage to lose function and die, cause the cell to lose the ability to reproduce, damage the cell's genetic code, or have no effect on the cell at all.⁴⁵ The rate at which a specific amount of tissue in the body absorbs RFR is known as the standard absorption rate ("SAR").⁴⁶ One of the largest concerns with cells absorbing RFR is the effect it has on cellular temperature.

Biological systems are highly temperature-sensitive. Every system is maintained at a specific homeostatic temperature to ensure efficiency and sustain life.⁴⁷ The smallest temperature increase can dramatically disrupt a cell's everyday mechanisms.⁴⁸ One degree can be the difference between a pathway working or coming to a crashing stop. When RFR is absorbed by a cell, it converts the radiation to Joule heat, thereby increasing the heat within a cell and disrupting its homeostatic temperature.⁴⁹

This temperature increase within cells can cause a slew of complications. For instance, temperature changes can cause enzymes to work at less efficient rates.⁵⁰ Enzymes are protein molecules that act as catalysts for specific biochemical

⁴² Moradi et al., *supra* note 36, at 2456.

⁴³ *Id.*

⁴⁴ *Id.*

⁴⁵ *Fact Sheet: 7. What Are the Health Effects of Ionizing Radiation?*, STATE OF NEW JERSEY DEP'T OF ENV'T PROT. (1996), <https://www.nj.gov/dep/rpp/llrw/download/fact07.pdf> [<https://perma.cc/3CGA-DARV>].

⁴⁶ *Specific Absorption Rate (SAR) for Cell Phones: What It Means for You*, FED. COMM'NS COMM'N (Oct. 15, 2019), <https://www.fcc.gov/consumers/guides/specific-absorption-rate-sar-cell-phones-what-it-means-you> [<https://perma.cc/75RR-8Y2V>].

⁴⁷ See *Homeostasis*, KHAN ACAD., <https://www.khanacademy.org/science/high-school-biology/hs-human-body-systems/hs-body-structure-and-homeostasis/a/homeostasis> [<https://perma.cc/23A8-ZPUD>] (explaining that the human body depends on temperatures being precisely within a range, if values get too high or low it can cause sickness).

⁴⁸ David H. Gultekin & Lothar Moella, *NMR Imaging of Cell Phone Radiation Absorption in Brain Tissue*, 110 PROC. NAT'L ACAD. SCI. U.S. 58, 58–59 (2012), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3538231/pdf/pnas.201205598.pdf> [<https://perma.cc/E4EX-FXA6>].

⁴⁹ *Id.* at 58.

⁵⁰ *Id.*

reactions.⁵¹ When enzyme efficiency decreases, it can slow down the basic biologic pathways essential to life.⁵² If the enzymes slow down enough, the pathways will not meet the threshold of energy required to carry out its biochemical reactions, and pathways can stop all together.⁵³

A 2013 study observed that cultured brain neurons placed into a gel and exposed to low levels of RFR recorded up to a 3°C increase in cell temperature.⁵⁴ The neurons in this experiment were devoid of any protections that would be typical of a neuron, like the skull and other tissues of the body.⁵⁵ However, a temperature increase of this magnitude would be detrimental to a normal healthy neuron.⁵⁶

Another study examined how cells in the brain react when exposed to current allowable SAR levels of RFR produced by wireless communication devices.⁵⁷ The study suggested that when exposed to this magnitude of radiation for 12 minutes, brain cells typically increased in temperature by 0.11°C.⁵⁸

While these temperatures may seem minimal, these cells had very limited RFR exposure. None of these studies have examined prolonged exposure. If scientists can demonstrate this type of heating for short periods of exposure, there is no telling what they would find if they examined 24-hour daily exposure over several decades.

It has often been thought that because wireless communication devices use low levels of RFR that users are not susceptible to thermal heating and thus are safe. However, a 2019 National Toxicology report discovered similarly detrimental results for rats exposed to current SAR limits over a period of time more consistent with a

⁵¹ M.J. Farabee, *Reactions and Enzymes*, ESTRALLA MOUNTAIN, <https://www2.estrellamountain.edu/faculty/farabee/biobk/BioBookEnzym.html> [<https://perma.cc/58KK-VJU8>].

⁵² Ben Himme, *Temperature & Enzyme Activity*, PATHWAYS, <https://www.pathwayz.org/Tree/Plain/ENZYMES+-TEMPERATURE> [<https://perma.cc/28QA-PEDR>].

⁵³ Farabee, *supra* note 51.

⁵⁴ *Id.*

⁵⁵ *About the Brain and Spinal Cord*, UNIV. OF PITT. SCH. OF MED., DEP'T OF NEUROLOGICAL SURGERY, <https://www.neurosurgery.pitt.edu/centers/neurosurgical-oncology/brain-and-brain-tumors/about> [<https://perma.cc/YQV7-U64Q>].

⁵⁶ Stefan Buzatu, *The Temperature-Induced Changes in Membrane Potential*, 102 RIVISTA DI BIOLOGIA 199 (2009) (It.).

⁵⁷ Gultekin & Moella, *supra* note 48, at 58.

⁵⁸ *Id.* at 60.

typical user's usage.⁵⁹ In this 2019 report, the National Toxicology Program published a first-of-its-kind study where they exposed male rats to 2G and 3G networks (RFR) on and off for 10 minutes at a time, 18 hours a day, for a total of nine hours a day for two years.⁶⁰ This study is the closest replication to the type of exposure humans experience that has ever been done. RFR levels were at or slightly above the FCC's set limits—the variation was due to their inability to precisely control RFR levels in an experimental setting.⁶¹ At the conclusion of the study, researchers found “clear evidence of tumors in the hearts of male rats,” as well as some evidence of tumors in the brains and adrenal glands of male rats.⁶² This study garnered significant buzz, as there was previously limited knowledge about potential health effects from long-term exposure to RFR.⁶³ Not only that, but the results yielded several statistically significant outcomes.⁶⁴ While it is not conclusive that RFR produced from wireless communication devices always causes tumors, this study certainly provides evidence that it is a real possibility.

Based on the evidence, it is impossible to believe that constantly exposing the human body to RFR through wireless communication devices has absolutely no effect on them.

II. HISTORY OF ELECTROMAGNETIC RADIOFREQUENCY RADIATION REGULATION

The FCC, FDA, Environmental Protection Agency (“EPA”), National Institute for Occupational Safety and Health (“NIOSH”), and the Occupational Safety and Health Administration (“OSHA”) all play a role in “monitoring and investigating issues related to RFR exposure.”⁶⁵ The source of RFR and who it affects determines what regulatory agency's rules and regulations govern.⁶⁶ For RFR originating from

⁵⁹ Wall St. J., *Cellphone-Cancer Link Found in Government Study*, YOUTUBE (May 27, 2016), <https://www.youtube.com/watch?v=HAgFGdFkJJE> [<https://perma.cc/5B27-DZ82>].

⁶⁰ *Cell Phone Radio Frequency Radiation*, U.S. DEP'T OF HEALTH & HUMAN SERVS., <https://ntp.niehs.nih.gov/whatwestudy/topics/cellphones/index.html> [<https://perma.cc/7SL2-K3XN>].

⁶¹ *Cell Phone Radio Frequency Radiation*, *supra* note 60; FDA, *supra* note 21 (explaining that variation is due to limitation of this type of research).

⁶² *Cell Phone Radio Frequency Radiation*, *supra* note 60.

⁶³ *Id.*

⁶⁴ *Id.*

⁶⁵ *Wireless Devices and Health Concerns*, *supra* note 19.

⁶⁶ *Id.*

wireless communication devices, regulation is primarily governed by two agencies: the FCC and the FDA.⁶⁷

A. Federal Communications Commission

The Federal Communications Act of 1934 (“FCA”) designated the FCC as the main regulatory authority on wireless communication.⁶⁸ In the 1930s, this authority reached only as far as the technology of the time.⁶⁹ As technology advanced and new forms of wireless communication devices came to fruition, the language of the FCA extended the FCC’s authority over new devices. Beginning in 1934 and the 30 years following, the FCC continually maintained the position that it lacked expertise on the interplay between radiation and its environment.⁷⁰ Accordingly, the agency refused to exercise its power and issue any formal regulations or guidelines regarding radiation emitted from wireless communication devices.⁷¹

The FCC remained silent on the topic until 1969, when Congress enacted the National Environmental Policy Act (“NEPA”), the first major environmental law in the United States.⁷² The purpose of NEPA was to “promote efforts which [would] prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man.”⁷³ Although NEPA was primarily focused the environment and made no mention of wireless communication devices, it required action on the part of the FCC.⁷⁴ In response to NEPA, the FCC finally issued guidelines “for evaluating the environmental impact of electromagnetic radiation and RF emissions.”⁷⁵

⁶⁷ *Id.*

⁶⁸ Goforth, *supra* note 17, at 332.

⁶⁹ *Id.*

⁷⁰ *Id.* at 333.

⁷¹ *Id.*

⁷² *The National Environment Policy Act of 1969*, OFF. OF NEPA POL’Y & COMPLIANCE, https://www.energy.gov/sites/default/files/nepapub/nepa_documents/RedDont/Req-NEPA.pdf [<https://perma.cc/PYD2-M82M>].

⁷³ *Id.*

⁷⁴ *Radio Frequency Safety*, FED. COMM’N COMM’N, <https://www.fcc.gov/general/radio-frequency-safety-0> [<https://perma.cc/AYH4-9QYG>].

⁷⁵ Goforth, *supra* note 17, at 333.

Despite the FCC exercising its authority by formally adopting guidelines, it continued to maintain the position that it lacked the necessary expertise to issue any rules on RFR limits.⁷⁶ It refused to examine the science and data on its own. Instead, the FCC relied on outside agencies—primarily the American National Standards Institute (“ANSI”), a private, non-profit organization dedicated to supporting the U.S. voluntary standards and conformity assessment system.⁷⁷ The FCC relied so heavily on outside agencies and their expertise that it essentially adopted whatever standards ANSI endorsed.⁷⁸

The FCC’s first set guidelines following NEPA remained in effect until 1992, when ANSI collaborated with the Institute of Electrical and Electronic Engineers (“IEEE”) and updated its exposure guidelines with more restrictive standards.⁷⁹ These new standards created two distinctive categories of RFR, each with different limits: “controlled environments” and “uncontrolled environments.”⁸⁰ Controlled environments were where a high RFR exposure was typical during the course of their work day.⁸¹ Uncontrolled environments described what the general public would encounter on a day-to-day basis.⁸² For uncontrolled environments, ANSI/IEEE C95.1-1992 set the SAR at 1.6 W/kg averaged over 1 gram of tissue.⁸³

The following year, the FCC initiated formal notice and comment rulemaking procedures to adopt the new combination ANSI/IEEE standards.⁸⁴ In the midst of the comment process, Congress enacted the Telecommunications Act of 1996 (“TCA”), which amended the FCA.⁸⁵ The TCA directed the FCC to complete rulemaking proceedings and “have revised RFR exposure guidelines in place by August 7,

⁷⁶ *Id.* at 382.

⁷⁷ *About ANSI*, AM. NAT’L STANDARDS INST., <https://www.ansi.org/about/introduction> [<https://perma.cc/4D8T-DDMW>]; Goforth, *supra* note 17, at 333.

⁷⁸ Goforth, *supra* note 17, at 333.

⁷⁹ *Id.*

⁸⁰ *Id.* at 334.

⁸¹ *Id.*

⁸² *Id.*

⁸³ Jacobsen, *supra* note 20, at 8.

⁸⁴ *Id.* at 26.

⁸⁵ *Id.*

1996.”⁸⁶ By August of 1996, the FCC complied and adopted ANSI/IEEE’s uncontrolled environment 1.6W/kg standard “for devices operating within close proximity to the body.”⁸⁷ The new “1996 regulations specifically indicated their application to ‘portable devices’ such as cell phones.”⁸⁸ Again, despite updated guidelines, the FCC still refused to acknowledge itself as having any expertise on RFR and continued to refer to their standards as only *guidelines*.⁸⁹

Since the guidelines were updated in 1996, ANSI, the International Commission on Non-Ionizing Radiation Protection (“ICNIRP”), and National Council on Radiation Protection (“NCRP”) have all issued updated versions of their standards, indicating that for the general public, a whole-body SAR should possibly be as low as 0.08 W/kg.⁹⁰ In fact, since the 1996 guidelines, ANSI and IEEE have issued multiple revisions and updates to their suggested SAR values, the last of these updates occurring in October of 2019.⁹¹ However, the FCC still has the original 1996 guidelines in effect today.⁹²

On March 27, 2013, the FCC voted to advance a new measure that would review several rules pertaining to NEPA.⁹³ Within this new measure, one fold of the plan designated a *Notice of Inquiry*, which “request[ed] comment to determine whether its RF exposure limits and policies need to be reassessed.”⁹⁴ The FCC implemented this procedure to determine whether the current RFR rules and policies

⁸⁶ Goforth, *supra* note 17, at 334.

⁸⁷ *Radio Frequency Safety*, *supra* note 74.

⁸⁸ Jacobsen, *supra* note 20, at 28.

⁸⁹ *Id.*

⁹⁰ 47 C.F.R. § 1.1310 (2020); Int’l Comm’n on Non-Ionizing Radiation Prot., *ICNIRP Guidelines for Limiting Exposure to Time-Varying Electric, Magnetic and Electromagnetic Fields (Up to 300 GHz)*, 74 HEALTH PHYSICS 494 (1998), <https://web.archive.org/web/20140606044606/http://www.icnirp.org/documents/emfgdl.pdf> [<https://perma.cc/HG5H-NTN4>]; NAT’L COUNCIL ON RADIATION PROT. & MEASUREMENTS, REPORT NO. 067—RADIOFREQUENCY ELECTROMAGNETIC FIELDS—PROPERTIES, QUANTITIES AND UNITS, BIOPHYSICAL INTERACTION, AND MEASUREMENTS (1981).

⁹¹ *IEEE C95.1-2019—IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 Hz*, IEEE STANDARDS ASS’N, https://standards.ieee.org/standard/C95_1-2019.html [<https://perma.cc/3MLL-CXMJ>].

⁹² *Radio Frequency Safety*, *supra* note 74.

⁹³ *Id.*

⁹⁴ *Id.*

should remain unchanged, relaxed, or tightened “in light of more recent developments.”⁹⁵

The 2013 investigation remained open until December 2019, when the FCC finally adopted new provisions that addressed these issues that had been pending for nearly seven years.⁹⁶ Much to the disappointment of advocates, the FCC indicated that RFR limits were to remain unchanged.⁹⁷ The report indicated that the FCC found “no appropriate basis for and thus decline[d] to propose amendments to [its] existing limits at this time.”⁹⁸ In its release, the FCC stated, “we believe [current RF guidelines] reflect the best available information concerning safe levels of RFR exposure for workers and members of the general public”⁹⁹ As described in the *National Law Review*, “the FCC declined to revisit its RFR exposure evaluation procedures for consumer portable devices, especially phones, [and] declined to revisit its RFR exposure policy as it pertains to children”¹⁰⁰ The report’s results seemed indicative of an agency that was confident that its 23-year-old guidelines were still applicable and could keep users safe from RFR emitted from wireless communication devices.

However, days after the 2019 report was published, the FCC proposed new rules to address:

the challenges of evolving technology. It propose[d] to expand the range of frequencies for which the RF exposure limits apply (currently 100kHz to 100 GHz) to a new upper limit of 3000 GHz; to reduce the spatial averaging area of the human body from the current 20 cm² to 1 cm² for higher frequencies; to establish a new “device-based time-averaging” and [sought] comments on

⁹⁵ *Id.*

⁹⁶ Michael T.N. Fitch, *Old Limits and New Procedures for FCC RF Exposure Rules*, LEXBLOG: BEYOND TELECOM L. BLOG (Jan. 23, 2020), <https://www.lexblog.com/2020/01/23/old-limits-and-new-procedures-for-fcc-rf-exposure-rules/> [<https://perma.cc/UH22-JWFQ>].

⁹⁷ *Id.*

⁹⁸ FCC, RESOLUTION OF NOTICE OF INQUIRY, SECOND REPORT AND ORDER, NOTICE OF PROPOSED RULEMAKING, AND MEMORANDUM OPINION AND ORDER 2 (Dec. 4, 2019), <https://docs.fcc.gov/public/attachments/FCC-19-126A1.pdf> [<https://perma.cc/3VZ7-CFR2>].

⁹⁹ *Id.*

¹⁰⁰ Fitch, *supra* note 96.

whether and how to apply it to ensure compliance with the RF exposure rules¹⁰¹

The proposed rules seemed to contradict the FCC's stance in its report that current guidelines were safe. The new rules appeared to highlight key issues that the FCC must have uncovered in its review and proposed new guidelines better equipped for more modern-day products and user usage.

B. Food & Drug Administration

In 1938 the Federal Food, Drug, and Cosmetic (FD&C) Act and Public Health Service Act were passed, granting the FDA the power to regulate medical products that emitted radiation.¹⁰² However, as radiation surpassed medicine and became more commonplace in everyday life, Congress recognized the need for regulation in that realm as well. Congress declared that “the public health and safety must be protected from the dangers of electronic product radiation.”¹⁰³ In doing so, Congress passed the 1968 Radiation Control for Health and Safety Act (“RCHSA”).¹⁰⁴ The act's purpose was to create performance standards for radiation-emitting products and minimize exposure to electronic radiation from products that are common to everyday life.¹⁰⁵ However, with the passage of the Safe Medical Device Amendments of 1990, Congress recodified the RCHSA to Title 21, authorizing the electronic product radiation control provision to the FD&C Act.¹⁰⁶

Under the FD&C Act, Congress directs the FDA to prescribe “performance standards for electronic products; . . . to minimize the emissions of and the exposure of people to, unnecessary electronic product radiation” so as to “carry out an electronic product radiation control program designed to protect the public health

¹⁰¹ *Id.*

¹⁰² *Federal Food, Drug, and Cosmetic Act (FD&C Act)*, U.S. FOOD & DRUG ADMIN. (Mar. 29, 2018), <https://www.fda.gov/regulatory-information/laws-enforced-fda/federal-food-drug-and-cosmetic-act-fdc-act> [<https://perma.cc/D69Y-G9CH>].

¹⁰³ Radiation Control for Health and Safety Act of 1968, Pub. L. No. 90-602, § 42, 82 Stat. 1173–1174.

¹⁰⁴ *Id.* at 1173–1187.

¹⁰⁵ *A History of Medical Device Regulation & Oversight in the United States*, U.S. FOOD & DRUG ADMIN. (June 24, 2019), <https://www.fda.gov/medical-devices/overview-device-regulation/history-medical-device-regulation-oversight-united-states> [<https://perma.cc/HZX7-VKGP>].

¹⁰⁶ Safe Medical Devices Act of 1990, Pub. L. No. 101-629, § 19, 104 Stat. 4511, 4529–4530 (1990), <https://www.govinfo.gov/content/pkg/STATUTE-104/pdf/STATUTE-104-Pg4511.pdf> [<https://perma.cc/MB38-SL4T>].

and safety from electronic product radiation”¹⁰⁷ Codified in 21 USC § 360ii(b)(1), the language of the act required the FDA to collect, analyze, and make “available, through publications and other appropriate means, the results of, and other information concerning, research and studies relating to the nature and extent of the hazards and control of electronic product radiation; and make such recommendations relating to such hazards and control” as considered appropriate.¹⁰⁸

Currently, the FDA’s official website states that it believes “that the weight of scientific evidence has not linked exposure to radio frequency energy from cell phone use with *any* health problems at or below the radio frequency exposure limits set by the FCC.”¹⁰⁹ It believes there is absolutely no public health or scientific data to support even the tiniest association between RFR discharged from wireless communication devices and adverse health issues.¹¹⁰ To date, the FDA has taken no affirmative actions to intervene in RFR produced by wireless communication devices. Interestingly enough, though, the FDA acknowledges that RFR does cause tissue heating.¹¹¹ As discussed earlier, tissue heating, can be detrimental to cells if sustained for a prolonged period of time and can be a precursor to other issues.¹¹²

Among other things, the FDA also acknowledges a list of several national and international organizations like the National Cancer Institute (NCI), World Health Organization (WHO), and National Toxicology Program (NTP), whose research and classifications it considers when establishing its own guidelines.¹¹³ Despite their admitted partial reliance on such organizations, the FDA’s view of RFR is in juxtaposition with many of them. The NCI and WHO both cite cellular device radiation as a possible carcinogen.¹¹⁴ Additionally, the NTP found what they believe

¹⁰⁷ 21 U.S.C. § 360ii(a).

¹⁰⁸ *Id.* at § 360ii(b)(1).

¹⁰⁹ *Do Cell Phones Pose a Health Hazard?*, U.S. FOOD & DRUG ADMIN. (Feb. 10, 2020), <https://www.fda.gov/radiation-emitting-products/cell-phones/do-cell-phones-pose-health-hazard> [<https://perma.cc/263K-Z7N8>] (emphasis added).

¹¹⁰ *Id.*

¹¹¹ *Id.*

¹¹² Gultekin & Moella, *supra* note 48, at 58–59.

¹¹³ *See Scientific Evidence for Cell Phone Safety*, U.S. FOOD & DRUG ADMIN. (Feb. 10, 2020), <https://www.fda.gov/radiation-emitting-products/cell-phones/scientific-evidence-cell-phone-safety> [<https://perma.cc/S2K7-P72Y>].

¹¹⁴ *Cell Phones and Cancer Risk*, NAT’L CANCER INST. (May 14, 2021), <https://www.cancer.gov/about-cancer/causes-prevention/risk/radiation/cell-phones-fact-sheet> [<https://perma.cc/3KMP-HSYQ>].

to be clear evidence of tumor growth following exposure to RFR after publishing a decade-long series of toxicology studies in 2018¹¹⁵—the FDA refuses to accept their conclusions because they claim it is outdated.¹¹⁶

In February 2020, the FDA released a report examining relevant *in vivo* and epidemiological studies investigating RFR's association with cancer.¹¹⁷ *In vivo* studies examine biological entities.¹¹⁸ They are studies conducted on “the whole, living organism.”¹¹⁹ These studies frequently involve animals and have been instrumental in making advances in modern medicine. According to the NICD, “the types of animals used in research are chosen for their similarity to humans in anatomy, physiology, and/or genetics.”¹²⁰ By using animals, researchers can learn how to “prevent, treat, and cure human diseases.”¹²¹ Essentially, *in vivo* studies are a gold standard in science. They are as close as researchers can get to the human body without conducting experiments on humans.¹²² However, in its 2020 Report, the FDA indicated that while *in vivo* studies contribute to the understanding of the potential effects of RFR, these studies contain critical limitations and thus cannot be used to “draw conclusions about the impact of such exposure to humans.”¹²³ The

¹¹⁵ News Release, Nat'l Inst. of Env't Health Scis., High Exposure to Radiofrequency Radiation Linked to Tumor Activity in Male Rats (Feb. 2, 2018), <https://www.niehs.nih.gov/news/newsroom/releases/2018/february2/index.cfm> [<https://perma.cc/3QYW-CYNZ>].

¹¹⁶ News Release, FDA, Statement from Jeffrey Shuren, M.D., J.D., Director of the FDA's Center for Devices and Radiological Health on the Recent National Toxicology Program Draft Report on Radiofrequency Energy Exposure (Feb. 2, 2018), <https://www.fda.gov/news-events/press-announcements/statement-jeffrey-shuren-md-jd-director-fdas-center-devices-and-radiological-health-recent-national> [<https://perma.cc/BD6D-DHBZ>].

¹¹⁷ FDA, *supra* note 21.

¹¹⁸ Jill Seladi-Schulman, *In Vivo vs. In Vitro: What Does It All Mean?*, HEALTHLINE (Aug. 19, 2019), <https://www.healthline.com/health/in-vivo-vs-in-vitro> [<https://perma.cc/56MZ-H5CF>].

¹¹⁹ *Id.*

¹²⁰ *The Important Role of Animals in Research at NIDCD*, NAT'L INST. ON DEAFNESS & OTHER COMMUN DISORDERS (Sept. 14, 2012), <https://www.nidcd.nih.gov/news/important-role-animals-research-nidcd-2012> [<https://perma.cc/Y3TE-HDUN>].

¹²¹ *Id.*

¹²² *Id.*

¹²³ FDA, *supra* note 21, at 34.

FDA refused to apply the results of all thirty-seven peer-reviewed articles relating to *in vivo* studies examining human cell phone usage.¹²⁴

Contrarily, the FDA concluded that the epidemiological studies supported its “findings that there is no quantifiable causal link between RFR exposure and tumor formation.”¹²⁵ It placed heavy reliance on the epidemiological studies it examined.¹²⁶

[E]xisting epidemiologic evidence is insufficient to suggest that use of cell phones can be considered as an independent etiological factor capable of influencing the incidence of intracranial and some other tumors in the general population. Existing epidemiological evidence indicates that if any risk does exist, it is extremely low compared to both the natural incidence of the disease and known controllable risk factors.¹²⁷

Historically, epidemiological studies have been viewed as tending “to produce less reliable data that can be more difficult to interpret.”¹²⁸ “For instance, it is extremely rare that an epidemiology study alone can confirm that a particular chemical exposure caused a health effect.”¹²⁹

So, while *in vivo* studies have been used for centuries and lauded for their influence on science and modern medicine and epidemiological studies show no more than a correlation unless backed by scientific studies, the FDA forwent accepted views on them. And while the FDA believed that its position was fully supported and that no further action was required, it promised to “continue to monitor available information.”¹³⁰

¹²⁴ *Id.*

¹²⁵ *Id.* at 87.

¹²⁶ *Id.*

¹²⁷ *Id.*

¹²⁸ *Are Epidemiology Studies Good Tools for Evaluating Chemical Safety?*, CHEMICAL SAFETY FACTS, <https://www.chemicalsafetyfacts.org/are-epidemiology-studies-good-tools-for-evaluating-chemical-safety/> [<https://perma.cc/5VKS-DTC2>].

¹²⁹ *Id.*

¹³⁰ FDA, *supra* note 21, at 87.

C. *International Organizations*

RFR is not just a national issue. International organizations have closely monitored the evolution of research in this area. The World Health Organization funds the International Agency for Research on Cancer (“IARC”) that identifies “environmental factors that can increase the risk of cancer in humans.”¹³¹ The agency conducts both epidemiological as well as laboratory research into the causes of human cancer.¹³² The agency classifies agents on the following scale:

- Group 1: Carcinogenic to Humans.
- Group 2A: Probably Carcinogenic to Humans.
- Group 2B: Possibly Carcinogenic to Humans.
- Group 3: Not Classifiable as to its Carcinogenicity to Humans.
- Group 4: Probably not Carcinogenic to Humans.¹³³

An agent is categorized based on the level of evidence IARC believes to be present in the scientific community.¹³⁴ IARC classifies radiofrequency fields as a “Group 2B: Possibly Carcinogenic to Humans” agent.¹³⁵ IARC interprets the 2B classification to mean there is limited evidence showing radiofrequency carcinogenicity in humans and less than sufficient evidence of carcinogenicity in experimental humans.¹³⁶ Other agents like lead, chloroform, and talc-based body

¹³¹ *Scientific Evidence for Cell Phone Safety*, U.S. FOOD & DRUG ADMIN. (Feb. 10, 2020), <https://www.fda.gov/radiation-emitting-products/cell-phones/scientific-evidence-cell-phone-safety> [<https://perma.cc/6XTF-XDAW>].

¹³² *IARC—International Agency for Research on Cancer*, WORLD HEALTH ORG., https://www.who.int/ionizing_radiation/research/iarc/en/ [<https://perma.cc/R3V5-HHTS>].

¹³³ Int’l Agency for Rsch. on Cancer, *Agents Classified by the IARC Monographs, Volumes 1–129*, WORLD HEALTH ORG. (July 22, 2021), <https://monographs.iarc.who.int/agents-classified-by-the-iarc/> [<https://perma.cc/P573-BJ97>].

¹³⁴ Int’l Agency for Rsch. on Cancer, *IARC Monographs on the Identification of Carcinogenic Hazards to Humans: Questions and Answers*, WORLD HEALTH ORG. (Dec. 10, 2019), https://monographs.iarc.who.int/wp-content/uploads/2018/07/QA_ENG.pdf [<https://perma.cc/F9YU-KSG7>].

¹³⁵ Press Release, Int’l Agency for Rsch. on Cancer, *IARC Classifies Radiofrequency Electromagnetic Field as Possibly Carcinogenic to Humans*, WORLD HEALTH ORG. (May 31, 2011), https://www.iarc.who.int/wp-content/uploads/2018/07/pr208_E.pdf [<https://perma.cc/N7WV-MSNB>].

¹³⁶ *Id.*

powder are also in the 2B classification.¹³⁷ Since their classification, lead, chloroform, and talc-based body powders all were heavily investigated and subsequently linked to cancer.¹³⁸ Talc-based baby powder, in particular, has been at the center of several multi-million dollar lawsuits for its connection to ovarian cancer.¹³⁹ In 2011, IARC classified RFR as a 2B carcinogenic.¹⁴⁰ It has been more than a decade, and, in that time, there have been significant strides in research. It is unclear how IARC revisits these classifications, but recent conclusions of several monumental studies on the effects of RFR on humans could result in a reclassification of RFR to a higher group.

III. LOOKING FORWARD

As of February 2020, it appears that the FCC and FDA do not currently intend to take any additional action by revising RFR guidelines, nor does it appear they intend to acknowledge any dangers posed by wireless communication devices.

Technology advances at a staggering rate, and American law has always managed to be two steps behind. The concern is that once the government does act, devices will be already be bigger, badder, and stronger, emitting higher frequencies of RFR, and its action could be too late. Since 1996 we have had the same regulations. Today we have devices that far exceed what seemed possible in the 1990s. There are wireless headsets, smart watches, tablets, etc., and we use these devices more than ever before. Thirteen percent of millennials and five percent of baby boomers spend over twelve hours actively on their phones per day.¹⁴¹ It is no longer 1996 when the occasional person had a cellphone in case of an emergency. Cellphones and other wireless communication devices are not a novel possession. In

¹³⁷ Int'l Agency for Resch. on Cancer, *Agents Classified by the IARC Monographs, Volumes 1-129*, WORLD HEALTH ORG. (July 22, 2021, 2:00 PM), <https://monographs.iarc.who.int/list-of-classifications> [<https://perma.cc/CF63-XXFZ>].

¹³⁸ Kyle Steenland & Paolo Boffetta, *Lead and Cancer in Humans: Where Are We Now?*, 38 AM. J. INDUS. MED. 295, 296 (2000); *Chloroform-ToxFAQs*, AGENCY FOR TOXIC SUBSTANCES & DISEASE REGISTRY (July 2014), <https://www.atsdr.cdc.gov/toxfaqs/tfacts6.pdf> [<https://perma.cc/BL2Z-SEAA>]; Daniel King, *Johnson & Johnson*, MESOTHELIOMA CTR. (Aug. 30, 2021), <https://www.asbestos.com/companies/johnson-johnson/> [<https://perma.cc/3KZE-38GP>]; *Talcum Powder and Cancer*, AM. CANCER SOC'Y (Feb. 4, 2020), <https://www.cancer.org/cancer/cancer-causes/talcum-powder-and-cancer.html> [<https://perma.cc/W7EF-US8D>].

¹³⁹ King, *supra* note 138.

¹⁴⁰ Press Release, WORLD HEALTH ORG.: INT'L AGENCY FOR RSCH. ON CANCER (May 31, 2011), https://www.iarc.who.int/wp-content/uploads/2018/07/pr208_E.pdf [<https://perma.cc/WVB4-LCP8>].

¹⁴¹ Brown, *supra* note 9.

2020 kindergarteners have cell phones, teens keep AirPods in their ears for hours on end each day, and people walk around with smartwatches on their wrists. But still, the FCC and FDA believe that U.S. citizens are safe under the guidelines established over two decades ago.

Take, for instance, budding 5G networks across the country. Certain networks have targeted higher frequency bands for 5G than have been used in previous generations.¹⁴² There is minimal research on the current frequencies used and little to none on these higher frequencies; we already do not have a clear picture of either of their effects on the body because of the lack of research. Additionally, 5G travels on what are known as millimeter wavelengths.¹⁴³ These wavelengths have a more difficult time traveling long distances and passing through barriers.¹⁴⁴ 5G networks are likely to require “up to five times the amount of infrastructure as 3G or 4G deployments.”¹⁴⁵ Accordingly, there will need to be more towers than ever before, closer to people;¹⁴⁶ we could see these towers popping up in neighborhoods and shopping centers. 5G networks have the potential to increase the basic baseline exposure users experience on the day-to-day. This is something that has not been researched before and something current laws are not prepared to handle.

If agencies choose not to act now, then by the time the next technology or the technology after that comes, it will be too late. Technology is not going anywhere. It is only going to get more advanced and widespread in use. To solve this problem, we must address it, and there are two avenues that the government can take: inform or edit.

A. *Inform*

First and foremost, the agency regulating a specific area needs to be the one most informed and capable of regulating the issue. Federal agencies “require close oversight or specialized expertise.”¹⁴⁷ For that reason, the FCC, an organization that

¹⁴² Marguerite Reardon, *Is 5G Making You Sick? Probably Not*, CNET (July 30, 2020, 5:00 AM), <https://www.cnet.com/news/is-5g-making-you-sick-probably-not/> [https://perma.cc/ME2A-YU8R].

¹⁴³ *Id.*

¹⁴⁴ *Id.*

¹⁴⁵ *Id.*

¹⁴⁶ *Id.*

¹⁴⁷ Will Kenton, *What Is a Federal Agency?*, INVESTOPEDIA (Aug. 16, 2021), <https://www.investopedia.com/terms/f/federal-agencies.asp> [https://perma.cc/9DGB-XVBE].

has repeatedly admonished that it has no business in the regulation of RFR due to its lack of knowledge,¹⁴⁸ should have no authority on the matter. The FDA should have sole regulatory power over RFR as it is a public health concern.

Whichever agency retains control needs to make updated data and guidelines accessible and known to the public at large in an easily available format for consumers. Although the majority of manufacturers include their SAR levels within their products' internal settings or in manuals, the information is often hidden or misrepresented.¹⁴⁹

For instance, to determine the SAR of a particular product on your phone, it will likely be in the "Legal" section in "General" or "About my Phone."¹⁵⁰ For iPhone users, it can be found under Settings > General > Legal > RF Exposure.¹⁵¹ Users then have to click on the provided link, which takes them to a webpage that gives both the 1.6W/kg guideline and the SAR of their specific device.¹⁵² However, the provided SAR values are useless. Although there is no mention of it, companies use a model known as the Standard Anthropomorphic Man ("SAM") to determine how much radiation is absorbed to cite these SAR values.¹⁵³ The model, SAM, is 6'2", weighs 200 lbs., and has a head that weighs 11 lbs.,¹⁵⁴ whereas the average man in North America is 5'9" and weighs 197 lbs., and ¹⁵⁵ the average woman is only 5'4" and weighs 170 lbs.; they do not consider children either.¹⁵⁶ The SAM model is

¹⁴⁸ Goforth, *supra* note 17, at 333.

¹⁴⁹ See CBC News, *Disconnect—Cell Phones—By Devra Davis*, YOUTUBE (Sept. 27, 2010), <https://www.youtube.com/watch?v=Xtd-y2C9IH4> [<https://perma.cc/TJX7-CLEE>] (recording of a clip from a CBC News about Devra Davis's book, *Disconnect: The Truth About Cell Phone Radiation, What the Industry Has Done to Hide it, and How to Protect Your Family*).

¹⁵⁰ Christian, *7 Ways to Check the SAR Value of Any Phone*, EMF ACADEMY, <https://emfacademy.com/check-sar-value-mobile-phone/> [<https://perma.cc/Z5MH-868P>].

¹⁵¹ *Id.*

¹⁵² *iPhone XR RF Exposure Information*, APPLE, <https://www.apple.com/legal/rfexposure/iphone11,8/en/> [<https://perma.cc/CUN8-2RJ5>].

¹⁵³ *Disconnect—Cell Phones—by Devra Davis*, *supra* note 149.

¹⁵⁴ *Id.*

¹⁵⁵ Cheryl D. Fryar et al., *Mean Body Weight, Height, Waist Circumference, and Body Mass Index Among Adults: United States, 1999–2000 Through 2015–2016*, 122 NAT'L HEALTH STATS. REPS. 1, 3 (2018), <https://www.cdc.gov/nchs/data/nhsr/nhsr122-508.pdf> [<https://perma.cc/9NJ7-9ND3>].

¹⁵⁶ *Id.*

not the average for any sex or age.¹⁵⁷ The values companies give are useless and deceptive. The average user will absorb more radiation than the presented SARs listed because the average user is nothing like SAM.¹⁵⁸

A solution to this problem would be to present SAR values differently. Values should be measured and represented based on the average build of a man and woman in the United States. Ideally, though, each product would be accompanied by a chart at purchase—like a body mass index chart—arranged by height and weight, where consumers could see how much RFR their particular body would absorb. This would not only better inform and protect adult users, but it would allow parents to better understand how a child's size affects their absorption of RFR.

Moreover, all devices should present the potential harm RFR can cause in a standardized way. When the public finally became aware that cigarette smoking was harmful and could lead to cancer, Congress made strides to make the information known.¹⁵⁹ In 1969 it passed the Public Health Cigarette Smoking Act that mandated the now well-known Surgeon General's warnings on the packaging of all tobaccos products as of November 1, 1970.¹⁶⁰ The original warning read: "WARNING: THE SURGEON GENERAL HAS DETERMINED THAT CIGARETTE SMOKING IS DANGEROUS TO YOUR HEALTH."¹⁶¹ The warning has since been updated, but since it has been affixed to cigarette boxes, smoking rates have dropped by as much as an estimated fifty-nine percent.¹⁶² In a sense, the purpose of the warnings is to dissuade individuals from using these products, but it could also serve a higher purpose—consumer awareness. A warning of this type informs users that qualified individuals believe there is at least some degree of credible risk to their health by using these products.

I propose a similar approach for wireless communication devices. All manufacturers should be required to attach a label to RFR-utilizing devices

¹⁵⁷ *Disconnect—Cell Phones—by Devra Davis*, *supra* note 149.

¹⁵⁸ *Id.*

¹⁵⁹ See *Making Decisions Regarding Tobacco Use*, R.J. REYNOLDS TOBACCO CO., <https://rjrt.com/tobacco-use-health/public-health-information/> [<https://perma.cc/M8PF-6JPL>].

¹⁶⁰ *Id.*

¹⁶¹ *Id.*

¹⁶² Liz Szabo, *U.S. Smoking Warning Made History, Saved Lives*, USA TODAY (Jan. 8, 2014, 7:36 AM), <https://www.usatoday.com/story/news/nation/2014/01/07/surgeon-general-report-made-history-saved-lives/4355275/> [<https://perma.cc/MP6R-XPDN>].

informing consumers that currently there is some credible evidence to indicate that prolonged exposure to low levels of RFR can be dangerous to consumers' health. The FCC already requires workplaces to label areas with high RFR exposure.¹⁶³ It is reasonable for them to extend this rule to products that consumers use and are around longer than an 8-hour shift at work. If thousands of workers deserve a warning, then so do the millions of cellphone users. Because of our increased reliance and dependence on such devices, a warning would by no means lead to a drastic reduction in the purchase or usage of these products. Still, it will lead to safer practices when using such devices, including monitoring and limiting use for young children, keeping devices farther away from the body on a regular basis, and not sleeping with the devices by the head. This is not a novel idea; France, Israel, India, Belgium, Russia, and Korea all require cellphones to display their SAR values on the device or packaging at the point of sale.¹⁶⁴

Additionally, industries respond to consumers. Having well-informed consumers and a warning label could lead to the development of devices that help minimize the body's absorption of RFR as well as push manufacturers to develop devices that emit less radiation. If we increase public awareness, the industry will attempt to rid itself of what the buyer wants to avoid.

There is no loss in educating the public. The worst consequence is creating a better-informed society that is more prepared to protect their own health.

B. EDIT

Another obvious remedy is reevaluating the currently available scientific information and creating stricter standards that actually protect users. However, given the 2019 and 2020 reports from the FCC and FDA, it seems unlikely they will change their stance; both agencies need to reevaluate the steps they have taken. Given the evidence at hand, it is shocking that these two agencies do not want to take *any* additional steps to reduce cellphone radiation given the evidence at hand. Other nations across the world have already stepped up and acknowledged they want to do better where RFR is concerned. France, Belgium, Switzerland, French Polynesia, Finland, Ireland, Germany, Greece, Israel, Turkey, Singapore, United Kingdom,

¹⁶³ Fitch, *supra* note 96.

¹⁶⁴ PAUL BEN ISHAI ET AL., PROPOSED FCC CHANGES TO MEASURING AND EVALUATING HUMAN EXPOSURE TO RADIOFREQUENCY ELECTROMAGNETIC FIELDS AND WIRELESS POWER TRANSFER DEVICES ARE FLAWED: NEED FOR BIOLOGICALLY-BASED STANDARDS app. 2 (2020), https://ecfsapi.fcc.gov/file/1061621406508/Appendix%20II_%20Worldwide%20Action%20on%20Cell%20Phones%20%20Wi-Fi%20and%20Wireless%20Radiation.pdf [<https://perma.cc/D2TP-SJSC>].

Russia, Denmark, India, Australia, Austria, Cyprus, Canada, Italy, Korea, Sri Lanka, Croatia, Krakow Poland all advise on reducing cellphone radiation.¹⁶⁵ Additionally, Canada, Russia, Israel, China, and Turkey have stricter national RFR limits than the United States.¹⁶⁶ RFR regulation is yet another area where the United States is not keeping up with other countries.

The new SAR guidelines issued by the FCC should also consider the person using the particular device. Guidelines should be stricter and more rigid for children because children have not yet fully developed and are more susceptible to the effects of RFR.¹⁶⁷ Other countries have already acknowledged the disparate impact RFR can have on children. Both Belgium and France have banned the sale of phones designed for children,¹⁶⁸ and France, Belgium, French Polynesia, Russia, and Turkey have banned marketing phones to children.¹⁶⁹ The United States should follow suit.

The FDA should reexamine their 10-year comprehensive plan to address these issues specifically, but this time considering *in vivo* experiments. Science does not currently have the capabilities to conduct the kind of pointed research that the FDA indicated it would need in order to consider these studies and apply the conclusions to humans.¹⁷⁰ *In vivo* studies provide us with the most accurate information we can produce aside from conducting experiments on humans.¹⁷¹ For the FDA to completely disregard these studies is essentially selecting results to fit their agenda. Even if the 2019 National Toxicology Program's experiment had significant errors, as the FDA indicated, their data still showed a dispositive propensity of RFR to cause tumors, and dozens of other studies have shown the same.¹⁷² Instead of trying to

¹⁶⁵ *Id.*

¹⁶⁶ *Id.*

¹⁶⁷ See Leeka Kheifets et al., *The Sensitivity of Children to Electromagnetic Fields*, 116 PEDIATRICS 303, 303 (2005), <https://pediatrics.aappublications.org/content/116/2/e303> [<https://perma.cc/WHP5-UH5F>].

¹⁶⁸ ISHAI ET AL., *supra* note 164, app. 2, at 3.

¹⁶⁹ *Id.*

¹⁷⁰ FDA, *supra* note 21, at 87.

¹⁷¹ See generally Sarah Moore, *In Vitro vs In Vivo Preclinical Studies*, NEWS MEDICAL (Feb. 23, 2021), <https://www.news-medical.net/life-sciences/In-Vitro-vs-In-Vivo-Preclinical-Studies.aspx> [<https://perma.cc/352Z-SCJ3>].

¹⁷² *Cell Phone Radio Frequency Radiation*, *supra* note 60.

apply these results to humans or recognizing that there is at least some degree of risk, the FDA completely wrote off the experiments as inapplicable.¹⁷³

Additionally, the FDA should consider the viewpoints and determinations of other credible national and international organizations that they claim on their website to rely on for scientific expertise. Although many of these cited institutions believe RFR can potentially cause cancer, the FDA still believes there is absolutely no risk.

IV. CONCLUSION

The FCC and FDA have failed in their obligation to prescribe safe RFR guidelines produced from wireless communication devices to protect the public health and safety. Devices are becoming more sophisticated, and their usage is as common to daily life as brushing your teeth. With each passing day, this problem is left unaddressed, air is being blown into a bubble that is one day going to burst and could leave us with one of the largest public health crises that the world has ever seen. Negligence has a price, and the result of this is one that every one of the five billion cellphone users will have to pay—even the people making the laws.¹⁷⁴ *Where is your cellphone now?*

¹⁷³ FDA, *supra* note 21, at 34.

¹⁷⁴ Silver, *supra* note 8.



PITTSFIELD BOARD OF HEALTH

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April 11, 2022

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EMERGENCY ORDER

REQUIRING THAT PITTSFIELD CELLULAR TELEPHONE COMPANY, D/B/A VERIZON WIRELESS, AND FARLEY WHITE SOUTH STREET, LLC, SHOW CAUSE WHY THE PITTSFIELD BOARD OF HEALTH SHOULD NOT ISSUE A CEASE AND DESIST ORDER ABATING A NUISANCE AT 877 SOUTH STREET ARISING FROM THE OPERATION OF A VERIZON WIRELESS CELL TOWER THEREON AND CONSTITUTING IMMEDIATE ORDER OF DISCONTINUANCE AND ABATEMENT IF NO HEARING IS REQUESTED

Pursuant to, *inter alia*, MGL 111 ss 122-125, 127-127I, 130, 143-144, 146-150, and State Sanitary Code 410.750, 410.831-832, 410.850-.960, the Board of Health deems the following actions necessary to protect the public health in the City of Pittsfield, State of Massachusetts.

Whereas, Verizon Wireless has constructed and operates a wireless telecommunications facility, a cell tower (the “facility”), located at 877 South Street, Pittsfield, Massachusetts, on property Verizon Wireless leases from owner Farley White South Street LLC. The Verizon Wireless facility was activated in August, 2020, and has been operating continuously since that date.

Whereas, soon after the facility was activated and began transmitting, the City started to receive reports of illness and negative health symptoms from residents living nearby the facility, and in particular, from residents living in the so-called “Shacktown” neighborhood. The negative health symptoms the affected residents have reported include complaints of headaches, sleep problems, heart palpitations, tinnitus (ringing in the ears), dizziness, nausea, skin rashes, and memory and cognitive problems, among other medical complaints.

Whereas, as further documented below, the neurological and dermatological symptoms experienced by the residents are consistent with those described in the peer-reviewed scientific and medical literature as being associated with exposure to pulsed and modulated Radio Frequency (“RF”) radiation, including RF from cell towers.

Whereas, those symptoms are sometimes referenced in the scientific and medical literature as electromagnetic sensitivity, also known as Electro-Hypersensitivity (“EHS”), Microwave Sickness, or Radiation Sickness. All these names describe a syndrome where the afflicted develop one or more

recognized symptoms as a result of pulsed and modulated RF radiation (“RFR”). EHS is a spectrum condition. For some, the symptoms can become debilitating, and severely affect their ability to function.

Whereas, the federal government has officially recognized this syndrome in various ways. For example, in 2002, the “Access Board,” an independent federal agency responsible for publishing Accessibility Guidelines used by the U.S. Department of Justice to enforce the Americans with Disabilities Act (“ADA”), recognized that “electromagnetic sensitivities may be considered disabilities under the ADA.”¹ The Access Board contracted for the publication of the National Institute of Building Sciences 2005 report, which concludes that radiofrequency/electromagnetic frequency (RF/EMF) radiation is an “access barrier,” and can render buildings “inaccessible” to those with electromagnetic sensitivity. The report recommends accessibility guidelines.² For ADA Title I purposes, the U.S. Department of Labor’s Office of Disability Employment Policy has issued guidelines for accommodations; these guidelines emphasize exposure avoidance and list as a resource, the EMF Medical Conference 2021 which trains medical doctors on the issue of electromagnetic radiation and health.^{3 4}

Whereas, The Centers for Disease Control’s 2022 Classification of Diseases Codes Clinical Modification and Procedural Classification System implements the International Classification of Diseases, 10th Revision, Clinical Modification (ICD-10-CM). The “diagnosis code” for Radiation Sickness” is “T66.”⁵ The “injury” code for “Exposure to Other Nonionizing Radiation” is “W90.”⁶ These codes cover electro-sensitivity along with other RF exposure-related injuries and maladies.

Whereas, the Health Board does not administer disability laws, but the foregoing authority strongly confirms that RF/EMF – even if emitted at levels within the FCC emissions guidelines – can be injurious to health or cause common injury to that significant portion of the public who are electromagnetic sensitive. Stated differently, pulsed and modulated RF can constitute a “public nuisance” or a “cause of sickness,” and can constitute a trade which may result in a nuisance or be dangerous to the public health for purposes of G.L. ch. 111 ss 122-125, 127B, 127C, 143-150, and 152.

Whereas, the federal government’s recognition that pulsed RF can directly cause harm to at least certain individuals or create an access barrier means that for the purposes of Massachusetts law, RF/EMF may effectively render certain dwellings Unfit for Human Habitation or constitute a Condition Which May Endanger or Materially Impair the Health or Safety and Well-Being of an Occupant as defined in State Sanitary Code 410.020 and 410.750(P).

Whereas, Verizon Wireless 877 South Street wireless facility is not itself a dwelling unit, but the Sanitary Code and other Massachusetts law allow the Health Board to act as necessary to ensure that

¹ U.S. Access Board. (n.d.). *Indoor Environmental Quality*. U.S. Access Board - Introduction. Retrieved March 31, 2022, from <https://www.access-board.gov/research/building/indoor-environmental-quality/>.

² *IEQ Indoor Environmental Quality Project (IEQ)*. (n.d.). National Institute of Building Sciences (NIBS), The Architectural and Transportation Barriers Compliance Board (Access Board). <https://www.access-board.gov/files/research/IEQ-Report.pdf>.

³ U.S. Department of Labor Office of Disability Employment Policy [Accommodations Webpage](#); Job Accommodation Network: [Accommodation and Compliance: Electrical Sensitivity](#) and [Accommodation and Compliance Series: Employees with Electrical Sensitivity Publication Downloads](#).

⁴ [EMF – Medical Conference 2021](#) Continuing Medical Education for physicians and health professionals. Several experts who presented to the Board and provided information also presented at the EMF Medical conference including Sharon Goldberg MD, Magda Havas PhD, Paul Héroux, PhD, Cindy Russell MD, Sheena Symington, B.Sc., M.A., Cecelia Doucette, and Theodora Scarato, MSW.

⁵ *2022 ICD-10-CM Diagnosis Code T66: Radiation sickness, unspecified*. (n.d.). Retrieved March 31, 2022, from <https://www.icd10data.com/ICD10CM/Codes/S00-T88/T66-T78/T66-/T66>.

⁶ *W90—ICD-10 Code for Exposure to other nonionizing radiation—Non-billable*. (n.d.). ICD-10 Data and Code Lookup. Retrieved March 31, 2022, from <https://icd10coded.com/cm/W90/>.

activity or operations in a non-dwelling building, structure, or facility do not contribute to conditions that impact occupants of a dwelling to the point they render a dwelling unfit for habitation for purposes of Sanitary Code 410.831.

Whereas, the Health Board has been presented with credible, independent, and peer-reviewed scientific and medical studies and reports that provide convincing evidence that pulsed and modulated RFR is bio-active and affects all living things over the long term. RFR can and does also cause more immediate harm and injury to human beings. The Health Board has also received strong evidence that the Verizon Wireless 877 South Street wireless facility is presently causing such harm and injury to numerous residents in the adjacent neighborhood.

Whereas, City of Pittsfield residents have submitted to the Health Board over 11,000 pages of evidence of studies, reports, and scientific and medical experts' opinion about the dangers to human health and the environment caused by exposure to wireless radiation.⁷ The Health Board also has heard testimony from medical professionals who directly treat patients injured by RF/EMF as well as testimony from scientific experts. The Board has been presented with personal testimony from many of the City of Pittsfield residents who have been personally harmed by pulsed and modulated RF radiation transmitted from the Verizon Wireless 877 South Street wireless facility's operations. *Specifically, but without limitation, the Health Board bases its conclusions, findings, and actions on all the scientific, medical, and personal evidence that has been submitted, but provides this general summary:*

1. The evidence presented to the Board includes well over one thousand peer-reviewed scientific and medical studies which consistently find that pulsed and modulated RFR has bio-effects and can lead to short- and long-term adverse health effects in humans, either directly or by aggravating other existing medical conditions. Credible, independent peer-reviewed scientific and medical studies show profoundly deleterious effects on human health, including but not limited to: neurological and dermatological effects; increased risk of cancer and brain tumors; DNA damage; oxidative stress; immune dysfunction; cognitive processing effects; altered brain development, sleep and memory disturbances, ADHD, abnormal behavior, sperm dysfunction, and damage to the blood-brain barrier.⁸
2. Peer-reviewed studies have demonstrated that pulsed and modulated RFR can cause the symptoms suffered by and personally attested to by City of Pittsfield's residents, including studies showing that these symptoms can develop as a result of exposure to cell towers specifically.
3. The symptoms described by City of Pittsfield's residents are often referred to in the scientific and medical literature as "electrosensitivity." The record evidence shows that exposure to pulsed and modulated RFR within the emission limits authorized by the FCC can cause the

⁷ [Environmental Health Trust et al. v. FCC Key Documents Volume 1, Volume 3, Volume 4, Volume 5, Volume 6, Volume 7, Volume 8, Volume 9, Volume 10, Volume 11, Volume 12, Volume 13, Volume 14, Volume 15, Volume 16, Volume 17, Volume 18, Volume 19, Volume 20, Volume 21, Volume 22, Volume 23, Volume 24, Volume 25, Volume 26, Volume 27](#) <https://ehtrust.org/environmental-health-trust-et-al-v-fcc-key-documents/>.

⁸ [The California Medical Association Wireless Resolution](#). (2015, March 9). *Environmental Health Trust*. <https://ehtrust.org/the-california-medical-association-wireless-resolution/>; bioadmin. (n.d.). [Conclusions—BIOINITIATIVE 2012—CONCLUSIONS Table 1-1](#). *The BioInitiative Report*. Retrieved March 19, 2022, from <https://bioinitiative.org/conclusions/>; bioadmin. (n.d.). [Table of Contents](#). *The BioInitiative Report*. Retrieved March 19, 2022, from <https://bioinitiative.org/table-of-contents/>; [EMFscientist.org—International EMF Scientist Appeal](#). (n.d.). Retrieved March 19, 2022, from <https://www.emfscientist.org/index.php/emf-scientist-appeal>.

symptoms, injuries, and mechanisms of harm associated with electrosensitivity and exhibited by the residents near the facility.⁹

4. Electrosensitivity describes a constellation of mainly neurological symptoms that occur as a result of exposure to pulsed and modulated RFR. The symptoms described in the scientific and medical literature include headaches, sleep problems, heart palpitations, ringing in the ears, dizziness, nausea, skin rashes, memory, and cognitive problems, among others. According to the evidence, exposure avoidance is the only effective management.

5. There are diagnosis guidelines. The European Academy of Environmental Medicine (EUROPAEM) published the “*EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses.*”¹⁰ These peer-reviewed guidelines cite 235 scientific references for symptoms, physiological damage, and mechanisms of harm. These guidelines have been used by doctors in the U.S. and throughout the world. Dr. Sharon Goldberg, MD, who diagnosed three City of Pittsfield residents with electro-sensitivity following their continuous exposure to the Verizon Wireless 877 South Street wireless facility, uses these guidelines. Dr. Goldberg has provided this Board with documentation and supporting information on the injuries suffered by these three Shacktown residents which Dr. Goldberg has opined to a reasonable degree of medical certainty have been caused by their exposure to the wireless radiation being emitted by this facility.

6. The recent U.S. government reports regarding the “mystery illness” of U.S. diplomats in Cuba, China, Austria, and elsewhere provide further support that pulsed RF can cause injury similar to that suffered by Shacktown residents. In December 2020, the National Academy of Sciences, Engineering, and Medicine (NAS) concluded¹¹ that the diplomats’ “mystery illness” is likely caused by pulsed RF. Prof. Beatrice Golomb, MD, PhD, 2018, wrote the first paper analyzing the science and showed that pulsed RFR is the likely cause of the symptoms suffered by some US diplomats in Cuba and China.¹² Her analysis relies on government studies as well as studies on commercial wireless devices and technology, and demonstrates how the diplomats’ symptoms can result from pulsed RFR exposure. Dr. Golomb concluded that the diplomats likely suffer from electrosensitivity (which she refers to as “Microwave Illness”). Most recently, on February 1, 2022, the federal government published a report adopting the conclusion of the NAS, finding that pulsed RFR is likely the cause of the diplomats’ sickness.¹³

⁹ Belyaev, I., Dean, A., Eger, H., Hubmann, G., Jandrisovits, R., Kern, M., Kundi, M., Moshhammer, H., Lercher, P., Müller, K., Oberfeld, G., Ohnsorge, P., Pelzmann, P., Scheingraber, C., & Thill, R. (2016). [EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses](https://doi.org/10.1515/reveh-2016-0011). *Reviews on Environmental Health*, 31(3), 363–397. <https://doi.org/10.1515/reveh-2016-0011> ; Bray, R. (n.d.). *Electromagnetic Hypersensitivity*. 81. <https://maisonsaine.ca/uploads/2016/09/ehs-bray-13-08-2016.pdf>.

¹⁰ Belyaev, I., Dean, A., Eger, H., Hubmann, G., Jandrisovits, R., Kern, M., Kundi, M., Moshhammer, H., Lercher, P., Müller, K., Oberfeld, G., Ohnsorge, P., Pelzmann, P., Scheingraber, C., & Thill, R. (2016). [EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses](https://doi.org/10.1515/reveh-2016-0011). *Reviews on Environmental Health*, 31(3), 363–397. <https://doi.org/10.1515/reveh-2016-0011>.

¹¹ National Academies of Sciences, E., and Medicine. (2020). *An Assessment of Illness in U.S. Government Employees and Their Families at Overseas Embassies*. The National Academies Press. <https://doi.org/10.17226/25889>.

¹² Golomb, B. A. (2018). *Diplomats’ Mystery Illness and Pulsed Radiofrequency/Microwave Radiation*. *Neural Computation*, 30(11), 2882–2985. https://doi.org/10.1162/neco_a_01133.

¹³ *Executive Summary DECLASSIFIED by DNI Haines on 1 February 2022*. (2022). https://www.dni.gov/files/ODNI/documents/assessments/2022_02_01_AHI_Executive_Summary_FINAL_Redacted.pdf.

7. As the record shows, there is evidence of clusters of sickness around cell towers. Evidence filed in the *Environmental Health Trust, et al. v. FCC case*¹⁴ and provided to the Board of Health shows that California firefighters developed electrosensitivity symptoms after a cell tower was installed on their stationhouse, including headaches, memory problems, sleeping problems, depression, and other neurological problems. SPECT brain scans found brain abnormalities. Additionally, TOVA testing found delayed reaction time, lack of impulse control, and difficulty in maintaining mental focus. Following these incidents, the International Association of Fire Fighters Division of Occupational Health Safety and Medicine investigated evidence of pulsed and modulated RF harm, and published a resolution opposing the use of fire stations as base stations for towers and/or antennas for the conduction of cell phone transmissions.¹⁵

8. In November 2020, New Hampshire's Commission to Study the Environmental and Health Effects of Evolving 5G Technology (the Commission was established by the State Legislature to learn about the health effects of 5G wireless radiation), published a report which concludes that RF emissions at levels below the FCC emissions guidelines can be harmful. The Committee's final report followed a thorough study of the evidence. The Committee's final report recommends adoption of cell tower antenna setbacks and acknowledges electrosensitivity and its association with RFR exposure.¹⁶ Dr. Kent Chamberlin, former Chair, Department of Computer and Electrical Engineering, University of New Hampshire, and Dr. Paul Heroux, PhD, Professor of Toxicology and Health Effects of Electromagnetism, McGill University Faculty of Medicine, two of the expert members of the New Hampshire Committee, have provided testimony to the Pittsfield City Council about the health effects of RFR exposure, and this testimony has been included in the record considered by this Board.

9. Other highly-credentialed, independent academic research experts have also offered testimony, at no cost, in support of residents' contentions that the Verizon Wireless 877 South Street wireless facility is the cause of their electrosensitivity symptoms. Experts include Dr. Martha Herbert, MD PhD, pediatric neurologist and former Assistant Professor at Harvard Medical School, and Dr. Magda Havas PhD., Professor Emeritus, Trent School of the Environment, Trent University.

10. Professor David Carpenter, MD, former Dean, School of Public Health at University of Albany, New York, wrote a letter to the City of Pittsfield in which he discussed studies showing that cell towers increase cancer risk, and cause changes in hormones as well as electrosensitivity symptoms, including headaches, fatigue, "brain fog," and ringing in the ears. Dr. Carpenter has published numerous studies on the negative health effects of electromagnetic radiation which have been submitted to this Board and are part of the record herein.¹⁷ Dr. Carpenter is the co-

¹⁴ *Envtl. Health Tr., et al. v. FCC*, 9 F.4th 893 (D.C. Cir. 2021).

¹⁵ [Cell Tower Radiation Health Effects](https://www.iaff.org/cell-tower-radiation/). (2004). *IAFF*. Retrieved March 19, 2022, from <https://www.iaff.org/cell-tower-radiation/>; Susan Foster Ambrose, M.S.W., Medical Writer. (2004). *INTERNATIONAL ASSOCIATION OF FIREFIGHTERS (IAFF) VOTES TO STUDY HEALTH EFFECTS OF CELL TOWERS ON FIRE STATIONS Call for Moratorium on New Cell Towers on Fire Stations Until Health Effects Can Be Studied*. Advancing Sound Public Policy on the Use of Electromagnetic Radiation (EMR). https://ehtrust.org/wp-content/uploads/pr_iaff_vote-1.pdf.

¹⁶ *Final Report of the Commission to Study The Environmental and Health Effects of Evolving 5G Technology* (HB 522, Chapter 260, Laws of 2019, RSA 12-K:12–14). (2020). State of New Hampshire. <http://www.gencourt.state.nh.us/statstudcomm/committees/1474/reports/5G%20final%20report.pdf>.

¹⁷ Bandara, P., & Carpenter, D. O. (2018). [Planetary electromagnetic pollution: It is time to assess its impact](https://doi.org/10.1016/S2542-5196(18)30221-3). *The Lancet. Planetary Health*, 2(12), e512–e514. [https://doi.org/10.1016/S2542-5196\(18\)30221-3](https://doi.org/10.1016/S2542-5196(18)30221-3).

editor of the BioInitiative Report,¹⁸ a scientific review of the science on RF/EMF by independent expert scientists. The report reviewed approximately 2,000 published studies on RFR health effects. After it was first released, the content of the Bioinitiative Report underwent peer review and was published in condensed form as a special two-volume issue of the Journal Pathophysiology. Additional chapters have been published in various journals.¹⁹ The Report concludes that bio-effects from wireless technology and infrastructure, including from cell towers, occur at radiation levels significantly below the FCC's emissions guidelines as documented in published research. The Report finds that the overwhelming majority of published neurological studies show bio-effects.²⁰ Over 90 percent of the studies that examine the oxidative stress mechanism (a mechanism of harm associated also with electro-sensitivity) show bio-effects.²¹ The Report contains cell tower exposure studies that show harmful effects of radiation emitted by cell towers, and demonstrate that exposure to pulsed RF causes hormonal and cell stress effects at radiation levels far, far lower than the FCC emissions guidelines.²² According to the 2012 Report's conclusion, public safety standards are 10,000 or more times higher than levels now commonly reported in mobile phone base station studies that reveal bio-effects. Because of the actual evidence of harm to humans from exposure to wireless radiation transmissions from cell towers, the Report uses mobile phone base station-RFR levels studies and other studies with very, very low RF exposures to determine the "lowest observed effect level" for RFR exposure as the basis for its recommendations for biologically-based exposure guidelines.²³

11. Dr. Cindy Russell, a medical doctor and the executive director of "*Physicians for Safe Technology*,"²⁴ provided a synopsis of 28 studies showing cell tower harm in her letter to this Board, dated July 6, 2021, which explains how it is "well established" that wireless radiation at non-thermal levels causes oxidative stress, and "oxidative stress plays a major part in the development of chronic, degenerative, and inflammatory illnesses such as cancer, autoimmune

¹⁸ bioadmin. (n.d.). Table of Contents. *The BioInitiative Report*. Retrieved March 19, 2022, from <https://bioinitiative.org/table-of-contents/>.

¹⁹ Martin Blank (Ed.). (2009). [Electromagnetic Fields \(EMF\) Special Issue](https://doi.org/10.1016/S0928-4680(09)00066-2). *Pathophysiology*, 16(2–3), CO2. [https://doi.org/10.1016/S0928-4680\(09\)00066-2](https://doi.org/10.1016/S0928-4680(09)00066-2); Hardell, L., & Sage, C. (2008). [Biological effects from electromagnetic field exposure and public exposure standards](https://doi.org/10.1016/j.biopha.2007.12.004). *Biomedicine & Pharmacotherapy*, 62(2), 104–109. <https://doi.org/10.1016/j.biopha.2007.12.004>; Herbert, M. R., & Sage, C. (2013). Autism and EMF? Plausibility of a pathophysiological link – Part I. *Pathophysiology*, 20(3), 191–209. <https://doi.org/10.1016/j.pathophys.2013.08.001>; Herbert, M. R., & Sage, C. (2013). Autism and EMF? Plausibility of a pathophysiological link part II. *Pathophysiology*, 20(3), 211–234. <https://doi.org/10.1016/j.pathophys.2013.08.002>.

²⁰ Neurological Effects Studies Percent Comparison, BioInitiative. (2022). <https://bioinitiative.org/wp-content/uploads/2020/10/13-Neurological-Effects-Studies-Percent-Comparison-2020.pdf>.

²¹ Henry Lai. (n.d.). Research Summaries. *The BioInitiative Report*. Retrieved March 19, 2022, from <https://bioinitiative.org/research-summaries/>; Neurological Effects Studies Percent Comparison, BioInitiative. (2022). <https://bioinitiative.org/wp-content/uploads/2020/10/13-Neurological-Effects-Studies-Percent-Comparison-2020.pdf>.

²² BUCHNER K, EGER H (2011) [A Long-term Study Under Real-life Conditions / Umwelt-Medizin-Gesellschaft](https://www.avaate.org/IMG/pdf/Rimbach-Study-20112.pdf) 24(1): 44-57. <https://www.avaate.org/IMG/pdf/Rimbach-Study-20112.pdf>.

²³ Henry Lai. (n.d.). Research Summaries. *The BioInitiative Report*. Retrieved March 19, 2022, from <https://bioinitiative.org/research-summaries/>; Neurological Effects Studies Percent Comparison, BioInitiative. (2022). <https://bioinitiative.org/wp-content/uploads/2020/10/13-Neurological-Effects-Studies-Percent-Comparison-2020.pdf>.

²⁴ Physicians for Safe Technology | Cell Tower Radiation Health Effects. (2017, September 11). *Physicians for Safe Technology*. <https://mindsafetech.org/cell-tower-health-effects/>.

disorders, aging, cataracts, rheumatoid arthritis, cardiovascular and neurodegenerative diseases, as well as some acute pathologies (trauma, stroke). Effects of oxidative stress are cumulative.”²⁵

12. Devra Davis PhD, MPH, the founder of the Environmental Health Trust, sent a scientific letter and briefing materials to this Board, documenting the published science indicating how FCC limits do not ensure safety to human health, and how legal levels of wireless radiation can damage the health of children, pregnant women, and the medically vulnerable. Studies of wireless radiation exposure from cell towers document neuropsychiatric problems, elevated diabetes, headaches, sleep problems, and genetic damage.²⁶ Attached to the letter were several published articles, including an article published in the journal *Lancet Planetary Health*, which presented an evaluation by the Oceania Radiofrequency Scientific Advisory Association of 2266 studies (including in-vitro and in-vivo studies in human, animal, and plant experimental systems and population studies). The evaluation found that most studies have demonstrated significant biological or health effects associated with exposure to anthropogenic electromagnetic fields.²⁷ Furthermore, a scientifically referenced Environmental Health Trust White Paper addressed common misconceptions around the health effects of wireless radiation.²⁸

13. These and other studies and reports in the record before this Board show that wireless radiation transmitted from cell towers can have adverse effects even when the pulsed and modulated RF emissions are significantly lower than the FCC’s emission guidelines. Compliance with FCC emission limits does not ensure safety nor protection from all harm. Published studies provided to the Board show negative health effects on human beings at legally allowed levels including: neurological effects and adverse effects on well-being, clear, measurable, physiological effects, hormonal changes, oxidative stress damage, negative effects on sperm, increased cancer risk, and DNA damage.²⁹

14. Epidemiological studies demonstrate that exposure to wireless radiation emissions from cell towers causes symptoms similar to those suffered by Shacktown residents as a result of the operation of the Verizon Wireless 877 South Street wireless facility. The record includes a 2010 review of wireless radiation exposure from cell towers and numerous other studies which are relevant to chronic long-term exposure similar to that from cell towers. Effects documented in these studies include various neurological symptoms such as fatigue, sleep problems, headaches and other effects on “wellbeing” proportionate to the distance from the cell tower.^{30 31 32} A

²⁵ Russell, C., (2021, July 6). [Cindy Russell MD to Pittsfield Board of Health. RE: Pittsfield testing of RFR emissions.](#) [Letter].

²⁶ Scarato, T., (2021, May 27). [Theodora Scarato to Gina Armstrong, City of Pittsfield Board of Health](#); Davis, D., et al., (2021, April 21). [Dr. Devra Davis, et al., to the Honorable Joseph R. Biden, President/Science/Briefing.](#) [Letters].

²⁷ Priyanka Bandara, David O Carpenter, [Planetary electromagnetic pollution: it is time to assess its impact](#), *The Lancet Planetary Health*, Volume 2, Issue 12, 2018, Pages e512-e514, ISSN 2542-5196, [https://doi.org/10.1016/S2542-5196\(18\)30221-3](https://doi.org/10.1016/S2542-5196(18)30221-3).

²⁸ [Myth Fact Scientific Response EHT 2022.](#)

²⁹ See Appendices I and II.

³⁰ Abdel-Rassoul, G., El-Fateh, O. A., Salem, M. A., Michael, A., Farahat, F., El-Batanouny, M., & Salem, E. (2007). [Neurobehavioral effects among inhabitants around mobile phone base stations.](#) *Neurotoxicology*, 28(2), 434–440. <https://doi.org/10.1016/j.neuro.2006.07.012>; Khurana, V., Hardell, L., Everaert, J., Bortkiewicz, A., Carlberg, M., & Ahonen, M. (2010). [Epidemiological Evidence for a Health Risk from Mobile Phone Base Stations.](#) *International Journal of Occupational and Environmental Health*, 16, 263–267. <https://doi.org/10.1179/107735210799160192>.

³¹ Levitt, B. B., & Lai, H. (2010). [Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays.](#) *Environmental Reviews*, 18(NA), 369–395. <https://doi.org/10.1139/A10-018>.

³² [78 Studies Showing Health Effects from Cell Tower Radio Frequency](#); Oberfeld, G., & Gustavs, K. (2007). *Environmental Medicine Evaluation* (30). 48.

telecom company study found exposure to cell towers causes a variety of neurological symptoms and a dose response. The study also found a causal relationship with sleep disturbance. When, unknown to the subjects, the company secretly turned off the antennas for three days, the sleep quality improved in all subject groups that were studied.³³

15. Evidence of electrosensitivity and its association to pulsed and modulated RF exposure, as well as evidence of harm to human health and the environment from exposure to wireless radiation from cell towers was filed in the case of *Environmental Health Trust, et al., v. Federal Communications Commission (FCC)* in the U.S. Court of Appeals for the District of Columbia Circuit. The petitioners challenged the FCC's decision in 2019 not to review and update its 1996 guidelines for wireless radiation emissions, following a multi-year proceeding to examine the developing science on the health and environmental effects of exposure to wireless radiation. The FCC determined in 2019 that its 1996 guidelines did not need to be updated.³⁴ On appeal, the DC Circuit court reversed the FCC, ruling in August 2021 that the FCC's determination that there is no evidence of non-cancerous and environmental harm from RF emissions below the FCC 1996 emissions guidelines was arbitrary, capricious, and not evidence-based. The DC Circuit court ruled that the FCC failed to explain why, despite the substantial evidence of harm filed in the FCC record, the agency decided to not further review its 1996 guidelines for possible updating. The DC Circuit remanded the case back to the FCC, and ordered the FCC to "*address the impacts of RF radiation on children, the health implications of long-term exposure to RF radiation*" as well as *environmental effects, new technological developments and adequacy of RF test procedures*. However, as of today's date, the FCC has not provided any response to the court order. Thus, while the 1996 FCC wireless emissions guidelines remain in effect, they have not been updated in 26 years, and they have not been substantiated by an up-to-date scientific review by any federal regulatory agency. Evidence provided to this Board confirms that when it comes to cell tower network RF emissions, there is no federal regulatory agency with health expertise monitoring the published science, nor providing surveillance for health effects, nor measuring RF levels in the environment.³⁵ As is also documented in a letter from the Environmental Protection Agency (the "EPA") to Theodora Scarato of Environmental Health Trust, the EPA has not reviewed the research on biological effects of exposure to wireless radiation since 1984.³⁶ The FDA has not reviewed the safety of environmental RF levels. The FDA stated in a letter³⁷ to a family requesting information on the safety of base station antennas that: "The Food and Drug Administration (FDA) does not regulate cell towers or cell tower radiation. Therefore, the FDA has no studies or information on cell towers to provide in response to your questions." The lack of oversight for the health effects of cell tower network radiofrequency exposure is a serious gap in

³³ Cherry, N.J. (2002). [Evidence of neurological effects of electromagnetic radiation: implications for degenerative disease and brain tumour from residential, occupational, cell site and cell phone exposures \(9\)](#).

³⁴ *Environmental Health Trust, et al v. FCC*, 9 F.4th 893 (D.C. Cir. 2021). [https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/\\$file/20-1025-1910111.pdf](https://www.cadc.uscourts.gov/internet/opinions.nsf/FB976465BF00F8BD85258730004EFDF7/$file/20-1025-1910111.pdf).

³⁵ [Myth Fact Scientific Response by Environmental Health Trust 2022, Theodora Scarato to Gina Armstrong, City of](#)

³⁶ [Pittsfield Board of Health](#); Davis, D., et al., (2021,

April 21). EPA letter is page 24 of [Dr. Devra Davis, et al., to the Honorable Joseph R. Biden, President/Science/Briefing \[Letters\]](#).

³⁷ Theodora Scarato presentation of the FDA letter in a video presentation submitted to Pittsfield Board of Health, [Pittsfield MA Expert Forum on Cell Tower Cease-and-Desist Order](#), at minute 54:24, and also in [Myth Fact Scientific Response EHT 2022](#), under section "Myth: The Food And Drug Administration (FDA) has reviewed the science on 5G and cell towers and determined the radiation is safe and FCC limits protect public health."

federal accountability, especially when research documenting harmful effects continues to be published in respected journals.

16. In November 2021, scientific and policy experts, including Dr. Linda Birnbaum, former Head of the National Institute of Environmental Health Sciences and National Toxicology Program, Dr. Ronald Melnick, National Institute of Health scientist (now retired), Dr. Anthony Miller, Dr. Jerome A. Paulson, Devra Davis, PhD, and several others, sent new requests to the FCC calling for a full examination of the latest scientific evidence in order for the U.S. to develop regulatory safety limits that protect the public and environment from wireless radiation exposure. Included in their filing are over 1,000 pages of reports and studies on demonstrating harm to humans from exposure to RF radiation, including electrohypersensitivity, and harm to humans from exposure to RF radiation from cell towers specifically. The Environmental Health Trust filing to the FCC docket also includes letters from the BioInitiative Report, Environmental Working Group, Consumers for Safe Cell Phones, Phonegate Alerts, and Dr. Kent Chamberlin.³⁸

17. The questions raised by the DC Circuit Court and the compelling scientific evidence submitted to this Board allows only one conclusion: pulsed and modulated RFR can and does cause harm, and at least a certain segment of the population can be severely harmed when exposed to this wireless radiation, especially for continuous periods of time. Exposure to wireless radiation can lead to significant temporary and possibly permanent injury, and according to the evidence, it seems that the most effective method to reduce the symptoms and mitigate the harm is through exposure avoidance.

18. This Board also finds that the information and testimony provided by Verizon Wireless do not convince this Board otherwise. In particular, this Board invited Verizon Wireless to meet by Zoom in September 2021 with Board Member Brad Gordon, then-Director of Public Health Gina Armstrong, and then-Senior Sanitarian (now current Director of Public Health) Andy Cambi to discuss the concerns of the City of Pittsfield Health Department, this Board, and residents of the City of Pittsfield about the wireless radiation emissions from the Verizon Wireless 877 South Street wireless facility ever since that facility was activated in August 2020. These concerns arose from the complaints reported by numerous residents of the adjacent residential neighborhood of negative health symptoms these residents and their relatives had been and were continuing to suffer from what they believed to be exposure to the continuous wireless radiation being transmitted from that Verizon Wireless facility. On September 9, 2021, Verizon Wireless appeared at the Board of Health Zoom session, represented by Verizon General Counsel New England Market, attorney Joshua E. Swift, Verizon Wireless Network Engineer, Jay Latorre, Verizon Wireless State and Government Affairs Director, Ellen Cummings, and Dr. Eric S. Swanson, Professor, Department of Physics and Astronomy, University of Pittsburgh. Professor Swanson was the primary spokesperson for Verizon Wireless at this meeting.

19. Professor Swanson presented prepared remarks, accompanied by a Powerpoint slide presentation. The Board did not place any time limits on Professor Swanson's presentation, and Ms. Armstrong and Mr. Gordon asked Professor Swanson many questions following his remarks. Professor Swanson's main points included: (a) electromagnetic radiation is the best understood phenomenon in the universe; it is not nuclear radiation; (b) electromagnetic waves form the

³⁸ [Reassessment of Federal Communications Commission Radiofrequency Exposure Limits and Policies](https://ecfsapi.fcc.gov/file/11302824721650/Remand%20Filing%20-%20Nov%2030th.pdf), (2021). ET Docket No. 13-84, <https://ecfsapi.fcc.gov/file/11302824721650/Remand%20Filing%20-%20Nov%2030th.pdf>; Linda S. Birnbaum, PhD, et al. (2021, November 24). *FCC Record Refresh Letter from Scientists to The Honorable Jessica Rosenworcel, Commissioner, Acting Chairwoman, Federal Communications Commission*. <https://ehtrust.org/wp-content/uploads/FCC-Record-Refresh-Letter-from-ScientistsWireless-Radiation.pdf>; [Scientific and Policy Developments in Radiofrequency Radiation](https://ehtrust.org/wp-content/uploads/New-Scientific-Developments-in-RFR-FCC-EHT-Remand-with-Studies-2.pdf) (2019 - 2021), <https://ehtrust.org/wp-content/uploads/New-Scientific-Developments-in-RFR-FCC-EHT-Remand-with-Studies-2.pdf>; [Environmental Working Group, The Bioinitiative Report, Consumers for Safe Cell Phones, New Hampshire State Commission on 5G.](https://ehtrust.org/wp-content/uploads/New-Scientific-Developments-in-RFR-FCC-EHT-Remand-with-Studies-2.pdf)

spectrum; (c) some radiation is ionizing which can sometimes cause cancer; (d) electromagnetic waves below the ionization threshold cannot cause cancer; (e) only wavelengths above visible light on the spectrum are ionizing; (f) wavelengths in the visible light portion of the spectrum are non-ionizing, and cannot cause cancer; (g) wavelengths below visible light on the spectrum, including thermal, microwave, 5G, 4G, and radio, are non-ionizing, and cannot cause cancer; (h) the only verified biological effect on tissue of non-ionizing radiation is heating; (i) the FCC regulates RFR to limit thermal effects, and FCC limits are very strict, set at 1/50 of the level of what is detectable in animal experiments; (j) the FCC limits are based on the evaluation of thousands of studies and the recommendations of expert organizations and agencies; (k) various international regulatory agencies and health organizations have concluded that there is no established evidence for health effects from radio waves used in mobile communications; (l) the FCC regularly updates its rules; (m) the consensus view of all scientists is that wireless radiation does not and cannot cause cancer; all studies to the contrary are from fringe scientists and those studies all show confirmation bias.

20. Following Professor Swanson's remarks, Ms. Armstrong acknowledged, without accepting, his contention that exposure to wireless radiation cannot cause cancer. But she pointed out that the immediate medical symptom residents of the Shacktown neighborhood adjacent to the Verizon Wireless 877 South Street wireless facility were complaining about were not cancer or thermal effects, but rather, headaches, tinnitus, and other conditions typical of electrohypersensitivity. Ms. Armstrong asked Professor Swanson to explain how to deal with those symptoms. Professor Swanson responded by insisting that the only verifiable biological effect of non-ionizing wireless radiation is heat, and the FCC so strictly regulates those emissions levels that heat cannot pose a problem from that Verizon Wireless cell tower. Professor Swanson acknowledged that certain people truly believe that they are hypersensitive to wireless radiation. But Professor Swanson suggested that those persons have psychological issues, and they should be dealt with sympathetically. Professor Swanson maintains that transmission of wireless radiation from Verizon's cell tower cannot actually cause those persons any injury because the immutable laws of physics make that impossible.

21. This Board has reviewed Professor Swanson's presentation and discussion and finds Professor Swanson's conclusions, several of which are strident and absolute, to lack credibility. A major problem with Professor Swanson is that he speaks as a purported expert about matters of human health and disease and medical and scientific studies about the health effects of exposure to wireless radiation, but he lacks any academic or professional qualifications in those fields. Professor Swanson is a professor of theoretical physics.³⁹ Professor Swanson's research interests focus on esoteric topics in nuclear physics, cosmology, and hadronic physics, especially in learning how "quarks" and "gluons" build the universe. All 124 of Professor Swanson's published scientific studies are limited to these subject areas.⁴⁰ Professor Swanson is not a medical doctor. Professor Swanson has no professional training or qualifications in medicine, medical research, biology, environmental studies, public health, epidemiology, or toxicology, and his professional credentials show no such expertise. *See* fn. 39. Yet Professor Swanson rejects the more than 2,000 peer-reviewed scientific studies showing that wireless radiation may or does negatively impact human health as outliers by "fringe" scientists who may be "conspiracy theorists" with an axe to grind, and asserts that their studies all show "confirmation bias." Professor Swanson asserts unequivocally that "the scientific consensus" is that wireless radiation cannot cause human harm. This Board finds that Professor Swanson lacks the qualifications and

³⁹ <https://www.physicsandastronomy.pitt.edu/people/eric-s-swanson>.

⁴⁰ <https://inspirehep.net/literature?sort=mostrecent&size=100&page=2&q=fin%20a%20swanson%2C%20e%20s>.

the expertise to make such sweeping statements, and his credibility as a witness is severely undermined thereby.

22. Further undermining Professor Swanson’s credibility is his appearance before this Board as a paid expert on behalf of Verizon Wireless, retained through his consulting business, Swanson Scientific Consulting.⁴¹ On Professor Swanson’s private consulting business website, he lists on the “Past Clients” tab, “Pittsfield, MA,” one of his 20 listed “Scientific Presentations and Depositions to Cities.” Professor Swanson also lists presentations to 5 State Senate Committees, the New York State Senators, the New Jersey Urban Mayors Association, and the Center for Growth and Opportunity. He names Verizon and Crown Castle Development (a major cell tower operator) as clients, as well as CTIA, the U.S. wireless industry’s trade and lobbying association. *See fn. 41.* This Board, in assessing Professor Swanson’s credibility, takes notice that he works as a paid industry consultant when making presentations such as the one he made to this Board regarding matters outside of his academic research and professional qualifications. In contrast, the experts who presented to this Board and spoke about the hazards to human health posed by wireless radiation from cell towers all had particular professional qualifications in the subject matter; none of these experts has received any compensation for their appearances before this Board, and all are independent academic researchers, with no affiliation to Verizon Wireless and the telecommunications industry. These facts enhance the credibility of these experts, especially vis-a-vis Professor Swanson.

23. Verizon Wireless also submitted to this Board documents which consist primarily of self-promotional brochures or industry-funded advocacy pieces rather than peer-reviewed scientific studies. These materials generally deny *any* prospect of harm, but do not meaningfully address the scientific evidence in the record or counteract the fact that the majority of independent (not industry-funded) studies, especially studies that use pulsed and/or modulated signals, do show harm.⁴² Verizon Wireless did not present government regulatory agency reports or systematic scientific or medical reviews of cell tower wireless radiation exposure studies (or studies of comparable levels of chronic environmental exposures) which conclude that safety to human health is assured. Furthermore, Verizon Wireless cannot and does not adequately rebut the personal testimonies provided by the residents of the neighborhood (“Shacktown”) in the City of Pittsfield adjacent to the Verizon Wireless 877 South Street wireless facility at the several public hearings before the Health Board of the actual harms they have suffered and are suffering from the operation of this wireless facility. Simply stated, the position of Verizon Wireless is that what is plainly happening in Pittsfield cannot occur. That position has been stated most clearly by Professor Swanson during his September 9, 2021 presentation to this Board. But this Board finds that, in fact, Shacktown residents have suffered, and are continuing to suffer, negative health effects from the continuous operation of the Verizon Wireless 877 South Street wireless facility since it was activated in August 2020.

24. The evidence shows that involuntary wireless radiation exposure directed upon Shacktown residents in their homes has effectively evicted several residents injured by pulsed and modulated RFR; they have no choice but to leave. Pulsed and modulated RFR from the Verizon Wireless 877 South Street wireless facility has rendered their homes uninhabitable – unfit for human habitation – because the continued exposure causes them severe pain, unable to function, and endangers and materially impairs their health and safety.

⁴¹ <https://swansonscientific.com/>.

⁴² Panagopoulos, D. J., Johansson, O., & Carlo, G. L. (2015). *Real versus Simulated Mobile Phone Exposures in Experimental Studies*. *BioMed Research International*, 2015, 607053. <https://doi.org/10.1155/2015/607053>.

Whereas, this Board has received direct testimony and written submissions from specific individuals that reside, or previously resided, within the reach of the wireless facility in issue. These residents state that they and/or other family members (including their children) have developed symptoms shortly after the facility was activated.⁴³ Many of the residents have testified on multiple occasions, which indicates the symptoms are persisting. It appears, based on the evidence, that there is a cluster of illness around the Verizon Wireless 877 South Street wireless facility that is caused by the facility's operation. Since no comprehensive survey has been conducted of all neighborhood residents, there may be additional affected residents.

Whereas, the symptoms reported by affected neighborhood residents are mainly neurological; they include headaches, ringing in the ears, dizziness, heart palpitations, nausea, and skin rashes. As the evidence that was provided to this Board shows, these symptoms are consistent with the scientific literature regarding adverse health effects from exposure to pulsed and modulated RF, including evidence specific to cellular antennas.

Whereas, this Board has received evidence from at least seventeen residents who have suffered on-going medical symptoms that arose for the first time after the Verizon Wireless 877 South Street wireless facility was activated in August 2020 and who believe their symptoms are caused by their continuous exposure to the wireless radiation being transmitted from that wireless facility. This Board finds their letters and oral testimonies to be authentic, compelling, and credible. As a result of their now-impaired health, some of these residents have decided to leave their homes, while others split their time between their homes in Shacktown and other temporary locations. This indicates that some affected Shacktown residents have been constructively evicted from their homes because of the operation of the wireless facility, and have been effectively rendered homeless. According to the evidence in the record, these symptoms are consistent with a diagnosis of electromagnetic sensitivity.

Whereas, this Board has received and reviewed, *inter alia*, the following evidence from specific Shacktown residents who have been and are being injured by the continued operation of the Verizon Wireless 877 South Street wireless facility:

1. REDACTED a pre-school teacher, has testified that she and both of her daughters developed various symptoms immediately after the facility went into operation. Ms. REDACTED has provided a physician's medical diagnosis by Dr. Sharon Goldberg, MD, an internal and environmental medicine physician. This diagnosis has linked REDACTED symptoms directly to the RF/EMF emitted by the facility by way of causation. REDACTED diagnosis letter indicates her symptoms improve when she is away from home, but resume when she returns and is again exposed again to the facility's radiation.
2. REDACTED s minor daughter, testified that after the facility went into operation, she and her sister both started getting headaches. They feel dizzy and develop sleeping problems. Her sister also suffered itchiness and developed skin rashes, frequent nausea, and often has to sleep with a bucket next to her bed in case she needs to throw up. Both girls have missed school because of sickness caused by wireless radiation exposure from the cell tower. REDACTED explained that when she is away from home (and out of range of the facility) she feels better.
3. REDACTED reported that following the facility's activation they began to suffer nausea, headaches, and dizziness. They are especially concerned for their five year old son who has Sensory Processing Disorder, a neurological disease. Since he has limited verbal skills, they do not know whether he too suffers from exposure to the wireless radiation transmitted from the cell tower. They are concerned that the exposure to the cell tower's emissions will aggravate

⁴³ See Appendix V: Public Comment Testimony to Board of Health.

his condition. The literature indicates that it is not unusual for individuals to have or develop sensitivity to multiple toxins, and this can become an escalating feedback loop.

4. REDACTED and their two children all developed headaches and insomnia after the facility became operational. They left their home because it is essentially uninhabitable and inaccessible to them.

5. REDACTED, an elderly resident, testified that both he and his wife have been unable to sleep since the tower was activated and that his wife has been especially affected.

6. REDACTED reported that they have been severely affected. He is nauseous and has headaches in the morning and again as soon as he returns from work.

7. REDACTED testified that she and her husband developed tinnitus and other serious health issues following the facility's activation. They are suffering from headaches and sleeplessness. They are deciding whether they must abandon their home because it is inaccessible and uninhabitable.

8. REDACTED testified that he developed ringing in the ears and that his wife Luci has developed horrible headaches and migraines. He stated that he sent his wife and their three year old daughter REDACTED away from the house because they believe it is unsafe and therefore uninhabitable. They are concerned for their daughter as she also has limited verbal skills and therefore they don't know if she suffers.

Whereas, this evidence clearly demonstrates to this Board that specific Shacktown residents in the vicinity of the facility have suffered and are suffering injuries and illnesses directly caused by the pulsed and modulated RFR emitted by the facility in issue, and for so long as the facility is in operation it will continue to be injurious to the public health and continue to drive residents from their homes.

Whereas, the FCC's emissions guidelines provide limits for general population purposes. These guidelines were designed to measure and address primarily only "thermal" or heating related effects. The guidelines for whole body exposure (such as for exposure from cell towers) are for 30 minutes exposure, and protect only from thermal injury. They were not developed to protect sensitive populations against all harms. They ignore the effects of pulsation and modulation and non-thermal effects from long-term chronic exposure, cumulative effects, and effects of exposure to numerous sources of RF exposure.

Whereas, the FCC emissions guidelines do not address the demonstrated scientific, medical, and even legally-established fact that these general population limits do not adequately recognize that pulsed and modulated RF radiation emissions are "bioactive" – living things biologically respond to pulsed and modulated RF radiation, and this response can lead to harmful effects. More importantly, these guidelines entirely fail to address or provide for the situation where, at least, certain individuals develop adverse reactions such as those who experience electromagnetic sensitivity.

Whereas, this Board concludes that the FCC emissions guidelines do not prevent this Board, operating under State authority, from taking action to protect the health and safety of those specific individuals who have demonstrated that a continuously operating cell tower built adjacent to a densely populated residential neighborhood is injuring their health on a continuing basis, as well as the health of other neighborhood residents. The FCC has ruled that state and local zoning authorities can condition a land use permit on compliance with generally applicable state or local health and safety codes.⁴⁴ Verizon

⁴⁴ *Broadband Deployment: Expanding the Reach and Reducing the Cost of Broadband Deployment by Improving Policies Regarding Public Rights of Way and Wireless Facilities Siting; 2012 Biennial Review of Telecommunications Regulations*, 29 FCC Rcd 12865, 122951, ¶202 (Oct. 17, 2014): ("We therefore conclude that States and localities may require a covered request to comply with generally applicable building, structural, electrical, and safety codes or with other laws codifying objective standards reasonably related to health and safety, and that they may condition approval on such compliance.").

Wireless' permit for this facility does precisely that. Verizon Wireless' permit expressly requires compliance with the Massachusetts Sanitary Code and Pittsfield's health-related rules, regulations and requirements. By this Order, this Board finds the Verizon Wireless 877 South Street wireless facility to be in violation, and this Board requires Verizon Wireless and the property owner to bring their facility and the premises into compliance with Massachusetts' and Pittsfield's generally applicable health and safety codes, just as FCC precedent and the permit expressly allow.

Now, therefore, the Pittsfield Board of Health hereby FINDS AND ORDERS as follows:

1. The Verizon Wireless 877 South Street wireless facility operated by Verizon Wireless is a public nuisance, a cause of sickness, and a trade which may result in a nuisance or be dangerous to the public health for purposes of G.L. ch. 111 ss 122-125, 127B, 127C, 143-150 and 152.
2. The premises owner, Farley White South Street LLC, is also responsible for all activities on its premises and within its direction and control.
3. The Verizon Wireless 877 South Street wireless facility operated on the premises creates an access barrier that directly causes harm to certain individuals, and renders dwellings Unfit for Human Habitation or constitutes a Condition Which May Endanger or Materially Impair the Health or Safety and Well-Being of an Occupant as defined in State Sanitary Code 410.020 and 410.750(P).
4. The Verizon Wireless 877 South Street wireless facility operated on the premises creates conditions that impact occupants of a dwelling to the point that it renders a dwelling unfit for habitation for purposes of Sanitary Code 410.831.
5. Verizon Wireless and Farley White South Street LLC are jointly and severally responsible for these unsafe conditions.
6. This Order shall be served on Verizon Wireless, through its authorized agents, and on Farley White South Street LLC, through its authorized agents, the persons responsible for the violations as provided by *inter alia*, G.L. ch. 111 ss 124, 127B, 127D, 144, and State Sanitary Code for 410.833, 410.850, and 410.851.
7. Verizon Wireless and Farley White South Street LLC are hereby ORDERED to show cause why the Board of Health should not issue an order requiring cessation of operations at the facility pursuant to the Board of Health's statutory and historical police power to protect its citizens from injury and harm.
8. Verizon Wireless and Farley White South Street LLC shall have SEVEN (7) DAYS from the date of this order to request a hearing on this Order to Show Cause. The Board of Health will promptly schedule such hearing in accordance with the provisions of G.L. ch. 111 and the State Sanitary Code, and provide public notice thereof.
9. In the event Verizon Wireless and Farley White South Street LLC do not timely request a hearing, this Order shall become and constitute a notice of discontinuance requiring that Verizon Wireless and Farley White South Street LLC abate and eliminate all activities and operations leading to the present and ongoing nuisance and violations of the State Sanitary Code at their own expense within SEVEN (7) DAYS of the expiration of the deadline to request a hearing.
10. Verizon Wireless and Farley White South Street LLC shall have the right to inspect and obtain copies of all relevant inspection or investigation reports, orders, notices, and other documentary information in the possession of the Board of Health; the right to be represented at the hearing.
11. Any affected party has a right to appear at said hearing and present evidence and argument in favor of or against discontinuance.

12. This is an important legal document. It may affect your rights.

The Health Board reserves the right to take such other and further action as it deems necessary to ensure that all injurious activities and conditions end, including directly acting to remove the offending facilities at the expense of Verizon Wireless and Farley White South Street LLC and or appointment of a receiver responsible for accomplishing the same.

This Order shall take effect upon issuance.

Appendix I: Letters and Testimony from Experts

All links provided by reference

Russell, C., (2021, April 6). [Cindy Russell MD to Council Members in the City of Pittsfield. Re: 3/21/21 Agenda Item #15 to encourage the Pittsfield, Massachusetts Health Department to investigate the health effects reported in the vicinity of the Verizon 877 South Street Cell tower.](#) [Letter].

Russell, C., (2021, July 6). [Cindy Russell MD to Pittsfield Board of Health. RE: Pittsfield testing of RFR emissions.](#) [Letter].

Carpenter, D.O., (2020, October 8). [Dr. David Carpenter to Mayor of the City of Pittsfield MA and Board of Health on Cell Tower Radiation](#) [Letter].

Kulberg, A.G., (2021, August 31). [Dr. Kulberg Chair of Pittsfield Board of Health to the Joint Committee on Consumer Protection RE: Senate Bill S.186 and in Support of MA Commission on Wireless Radiation.](#) [Letter].

Havas, M., (2021, July 6). [Dr. Magda Havas to Gina Armstrong, Director of Public Health, Pittsfield Health Department, City of Pittsfield MA on Cell Tower Radiation Measurements and the Lack of Protections by the FCC.](#) [Letter]. [Slide Presentation for BOH Forum.](#)

Heroux, Paul., (2021, July 7) [Paul Héroux, PhD, McGill University Medicine Comments on RF EMISSION STUDY of South St cell tower \(SSct\) on June 10th by VComm Telecommunications Engineering.](#) [Letter].

White, P., (2021, October 4). [Peter White, Councilor City of Pittsfield to Massachusetts State Legislature in Favor of Wireless Right to Know Legislation.](#) [Letter].

Scarato, T., (2021, May 27). [Theodora Scarato to Gina Armstrong, City of Pittsfield Board of Health](#); Davis, D., et al., (2021, April 21). [Dr. Devra Davis, et al., to the Honorable Joseph R. Biden, President/Science/Briefing on Wireless.](#)[Letters]. [Myth Fact Scientific Response EHT 2022.](#)

Boston Petitioners, (1997). [Boston Physicians' and Scientists' Petition To Avert Public Exposures to Microwaves.](#) [Petition Signatures].

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Chamberlain, K., (2022, February 20). [Kent Chamberlin PhD to Editor of the Berkshire Eagle Re: Response to Feb 19th Opinion on Verizon Cell Tower.](#) [Letter].

Goldberg, S. (2022, February 28). *Wireless Health Effects* [Slides from presentation]. <https://ehtrust.org/wp-content/uploads/Sharon-Goldberg-MD-Pittsfield-MA-2.28.22.pdf>.

Appendix II Testimony and Research on Cell Towers and Radiofrequency

Note: This is not an exhaustive list, but rather a short list of studies included in evidence sent to the Board.

Compilation Documents

REDACTED testified repeatedly to the Board, communicated by email and submitted extensive scientific research, video lectures, documentation of health effects and reports.

Michael Maudin, (Numerous letters 2021 and 2022) The Alliance for Microwave Radiation Accountability, Inc. Sent the Board numerous resources, scientific papers, and documents demonstrating evidence of adverse effects, research dating back decades on electromagnetic radiation and more including links [Primary Source Documents - Microwave Radiation Syndrome in April 2021](#), [Michael Maudin's testimony of injury from base station antennas](#) and primary source documents. [Microwave-Radiation-Syndrome-Primary-Source-Documents-BoH-April-2021.pdf](#). Maudin also sent 35 peer-reviewed studies and charts on microwave sickness caused by the radiation from cell

towers to the Pittsfield Board of Health on January 5, 2021 and these are included in the reference list.

[Compilation of Research Studies on Cell Tower Radiation and Health](#). (n.d.). *Environmental Health Trust*. Retrieved March 20, 2022, from <https://ehtrust.org/cell-towers-and-cell-antennae/compilation-of-research-studies-on-cell-tower-radiation-and-health/>

Maryland Children's Environmental Health and Protection Advisory Council (2016) [78 Studies Showing Health Effects from Cell Tower Radio Frequency](#).

Research Studies

Gandhi, G., Kaur, G., & Nisar, U. (2015). A cross-sectional case control study on genetic damage in individuals residing in the vicinity of a mobile phone base station. *Electromagnetic Biology and Medicine*, 34(4), 344–354. <https://doi.org/10.3109/15368378.2014.933349>.

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Appendix III: Videos Resources Sent to Board of Health

[Pittsfield MA Expert Forum on Cell Tower Cease-and-Desist Order](#): With Senator Denise Ricciardi, NH; Dr. Paul Héroux; Dr. Magda Havas; Dr. Kent Chamberlin; Dr. Sharon Goldberg, Environmental Health Trust Director Theodora Scarato; Attorney Robert Berg; Attorney Scott McCollough.

[Pittsfield MA Cell Tower Discussion 5 July 2021](#): Dr. Kent Chamberlin, EHTrust Policy Director Theodora Scarato & MA for Safe Technology Director Cecelia Doucette.

[Town of Lenox Board of Health Remote Meeting, August 19, 2021, with presentation by Kent Chamberlin, Ph.D., on Cell Tower Research.](#)

[Sacramento City Council Meeting: Includes testimony of two young girls who became sick after Verizon cell installation was powered up.](#)

[Wireless Radiation- What Environmental Health Leaders Need to Know](#): Featuring Linda Birnbaum, former Director of the National Institute for Environmental Health Sciences and the National Toxicology Program • Michael Lerner, Co-Founder and President of Commonweal and Co-Founder of Collaborative on Health and the Environment • Joel M. Moskowitz, PhD, Director Center for Family and Community Health, School of Public Health, University of California- Berkeley and Founder of Electromagnetic Radiation Safety • Uloma Uche, PhD, Environmental Working Group, author of new study on hazards of wireless radiation on children. • Sharon Buccino, Legal Expert, NRDC • Cindy Russell, MD Founder of Physicians for Safe Technology • Larry Ortega, Founder of Community Union • Theodora Scarato, Executive Director of the Environmental Health Trust.

Appendix V: Public Testimony to the Board of Health

All links provided by reference.

In addition to public testimony referenced below, Pittsfield residents submitted numerous emails, documents and letters to the Board.

Board of Health Meetings

April 12, 2021

Agenda:[https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards Commissions Calendar/Board of Health/BOH_04_12.pdf](https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board_of_Health/BOH_04_12.pdf)

Meeting link: <https://watch.pittsfieldtv.net/CablecastPublicSite/show/38962?channel=9>

May 5, 2021

Agenda:[https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards Commissions Calendar/Board of Health/BOH_05_05.pdf](https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board_of_Health/BOH_05_05.pdf)

Meeting link: <https://watch.pittsfieldtv.net/CablecastPublicSite/show/40347?channel=9>.

June 2, 2021

Pittsfield Board of Health Wireless Harm Expert Forum:

Agenda;[https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board of Health/BOHAgenda_06_02.pdf](https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board_of_Health/BOHAgenda_06_02.pdf).
Meeting Link; <https://watch.pittsfieldtv.net/CablecastPublicSite/show/40684?channel=9>.

July 7, 2021

VComm presents readings from the cell tower (first in person meeting)

Agenda;[https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board of Health/BOH_07_07.pdf](https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board_of_Health/BOH_07_07.pdf).
Meeting link; <https://watch.pittsfieldtv.net/CablecastPublicSite/show/40992?channel=9>.

September 1, 2021

Agenda;[https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board of Health/BoardofHealth_09_01.pdf](https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board_of_Health/BoardofHealth_09_01.pdf).
Meeting link; <https://watch.pittsfieldtv.net/CablecastPublicSite/show/41536?channel=9>

October 6, 2021

Agenda;[https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board of Health/BoardofHealth_10_06.pdf](https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board_of_Health/BoardofHealth_10_06.pdf).
Meeting link; <https://watch.pittsfieldtv.net/CablecastPublicSite/show/41802?channel=9>.

November 3, 2021

Agenda;[https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board of Health/BoardofHealth_11_03.pdf](https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board_of_Health/BoardofHealth_11_03.pdf).
Meeting link; <https://watch.pittsfieldtv.net/CablecastPublicSite/show/43053?channel=9>.

December 1, 2021

Agenda;[https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board of Health/BoardofHealth_12_01.pdf](https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board_of_Health/BoardofHealth_12_01.pdf).
Meeting link; <https://watch.pittsfieldtv.net/CablecastPublicSite/show/43228?channel=9>.

February 2, 2022- Cease and desist unanimously voted on

Agenda;[https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board of Health/BoardofHealth_02_02.pdf](https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board_of_Health/BoardofHealth_02_02.pdf).
Meeting link; <https://watch.pittsfieldtv.net/CablecastPublicSite/show/43842?channel=9>.

February 23, 2022-Executive session for cease and desist order- order upheld

Agenda;[https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board of Health/BoardofHealth_02_02.pdf](https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board_of_Health/BoardofHealth_02_02.pdf).
Meeting link; <https://watch.pittsfieldtv.net/CablecastPublicSite/show/44040?channel=9>.

March 16, 2022-Second executive session for the cease and desist order

Agenda:[https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board of Health/BOH_03_16.pdf](https://cms2files.revize.com/pittsfieldma/calendar_app/docs/Boards_Commissions_Calendar/Board_of_Health/BOH_03_16.pdf)

Meeting link; <https://watch.pittsfieldtv.net/CablecastPublicSite/show/44241?channel=901:45>

Additional Testimony at City Board Meetings

Pittsfield residents and scientific experts testified at numerous City Council meetings as well as other City Board Meetings providing testimony on harm.

November 5, 2020 Community Development Board Meeting

[Pittsfield Community Development Board - November 5, 2020](#)

Topic: Cell towers setbacks

Community Development Board December 1, 2020

<https://watch.pittsfieldtv.net/CablecastPublicSite/show/37825?channel=9>

Certified and Regular Mail: [7021-0350-0000-4282-0554](tel:7021-0350-0000-4282-0554) (Pittsfield Cellular Telephone Company, Atty. Ellen W. Freyman)

Certified and Regular Mail: [7021-0350-0000-4282-0547](tel:7021-0350-0000-4282-0547) (Pittsfield Cellular Telephone Company, Mark J. Esposito, Esq.)

Certified and Regular Mail: [7021-0350-0000-4282-0530](tel:7021-0350-0000-4282-0530) (Farley White South Street, LLC, Roger W. Altreuter, Manager)

ORDERED by unanimous vote of the Pittsfield Board of Health on April 7, 2022

Roberta Orsi, MS, RN, CCP, Chairperson

Kimberly Loring, PMHNP-BC

Steve Smith, MA

Brad Gordon, JD

Jeffery A. Leppo, MD – Not Present-Did Not Participate

Electromagnetic Radiation

And Honey Bee Health - Part 1

The potential for harmful impacts from electromagnetic radiation to bees first came into the general public's consciousness shortly after the emergence of Colony Collapse Disorder (CCD). It was the result of reports of a study in which cordless telephone base stations that emitted 1900-MHz electromagnetic field (EMF) radiation were set in hives and found to decrease comb building and increase the duration of foraging trips. (Kimmel et. al. 2007) The study was poorly designed, had a small sample size, and there was the small issue that beekeepers do not typically place mobile phone base stations used by cordless landline phones in their hives. As a result the idea of electromagnetic radiation harming bees was quickly discredited and became the subject of jokes and ridicule. I certainly wrote it off as inconsequential. This was an unfortunate situation because I have since found that when you look at the studies on the subject with an independent mind, there just happens to be enough peer reviewed research to suggest that there may in fact be cause for concern. The collective evidence drawn from scientific studies of the adverse health and biological impacts of artificial electrical field exposure from sources such as cell phone towers, cell phones, smart meters, power lines and WiFi routers may be jeopardizing the health of our bees and more.

What is EMF and EMR?

An electromagnetic field (EMF) is produced when electric and magnetic charges radiate energy (aka radiation). Electromagnetic radiation (EMR) is a kind of energy that includes radio waves and visible light. Even solar wind generated from the sun creates an electromagnetic field as it hits the earth which means that all life on earth is in the presence of electromagnetic fields. EMF radiation in wireless communication only works because the transmission is more powerful than the natural background radiation. These man-made sources of electromagnetic radiation

greatly increase normal background exposure. Common sense suggests that biologically based scientifically sound public exposure standards be developed to protect the health and well-being of people, bees and other wildlife. Unfortunately, such standards do not exist for pollinators and wildlife, and studies suggest that even the human standards that exist are outdated and inadequate.

Electromagnetic radiation is measured in hertz (Hz) which represents the cycles per second of the wavelength. One hertz represents a single time that a analog sound wave or digital pulse repeats each second (e.g. one cycle per second). Kiloherz (kHz) measures thousands of cycles per second, Megahertz (MHz) refers to millions and Gigahertz billions of cycles per second. It is well established that EMR has the ability to seriously impact living organisms and that EMR of 900 MHz is highly bioactive causing significant changes in the physiological function of living organisms. (Aday 1975)

Radiofrequency electromagnetic fields (RF-EMF) are emitted from the wireless communication devices we use daily: radios and televisions, satellite communication systems, WiFi systems and wireless mobile phones and cell phones. RF-EMFs emit non-ionizing radiation. This differs from ionizing radiation of nuclear power plants in that while non-ionizing radiation has enough energy to excite the electrons in molecules and atoms (moving the electrons to a higher energy state) they do not knock electrons out of their orbits around atoms like ionizing radiation does.

The agency responsible for regulating the wireless communications industry is the Federal Communications Commission (FCC). Unfortunately, FCC radiofrequency (RF) safety guidelines have not been updated since their implementation in 1996. This is significant since these fields are about to get significantly stronger with the current roll-out of the fifth generation technology standard (aka 5G) for broadband cellular networks.

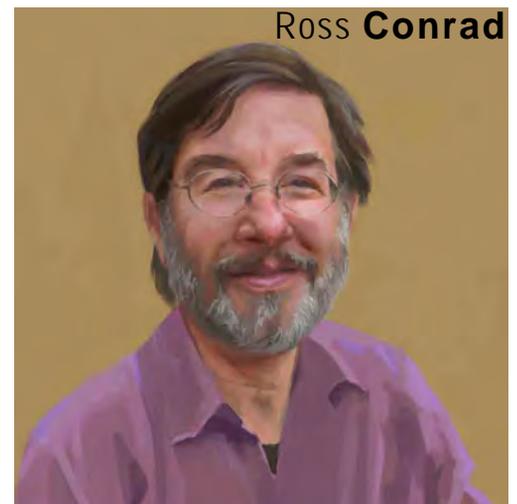
Today no-one, including the Federal Communications Commission (FCC) knows whether 5G is safe or not. Even wireless carriers have to admit that they are not aware of any independent studies on 5G safety. When asked during Senate hearings what research has been done on the safety of 5G technology, the answer was "none". (Blumenthal 2019)

Meanwhile, the public is consistently told that there is no need for anything to worry about concerning the rollout of this new technology that the FCC is pushing and if current plans come to fruition has the potential to result in over 800,000 new antenna installations throughout the U.S. providing fast 5G internet service to many Americans by the end of the decade.

Effects on insects

There is a growing body of evidence of harm from wireless non-ionizing radiation such as from cell phones, cell towers, WiFi, and smart meters can harm insects. A 2013 review of 113 studies that found that 70 percent of papers analyzed reported a significant impact of RF-EMF on birds and insects. This suggests an urgent need for more research and repetitions of studies given the fast pace of cellular telephone technological progress. (Cucurachi et. al. 2013)

Lab studies on insects show negative effects of EMR on reproductive success, development, and naviga-



tion abilities. However, the impact of widespread mobile telecommunication antennas on wild pollinator communities in field-realistic conditions is still largely unknown. In one trial, beetle, wasp and hoverfly abundance **decreased** with EMR, while the abundance of underground-nesting bees and bee flies **increased** with EMR. This cries out for additional research to understand the ecological impacts of EMR on wild pollinators and the subsequent effects on plant diversity, crop production, as well as human welfare. (Lázaro et. al. 2016)

In 2012 Sivani and Sudarsanam published a paper that states: “Based on current available literature, it is justified to conclude that RF-EMF radiation exposure can change neurotransmitter functions, blood-brain barrier, morphology, electrophysiology, cellular metabolism, calcium efflux, and gene and protein expression in certain types of cells even at lower intensities. The biological consequences of such changes remain unclear.” The authors further noted that short-term studies on frogs, honey bees, birds, bats and even humans are scarce and long-term studies are non-existent.

A review of the literature published just this past year came to the

Cell phones and the towers use to transmit their signals are just one of many sources of man-made electromagnetic radiation.



conclusion that there is sufficient evidence to support claims of damage caused by electromagnetic radiation. The study’s author goes on to state that “...electromagnetic radiation should be considered seriously as a complementary driver for the dramatic decline in insects, acting in synergy with agricultural intensification, pesticides, invasive species and climate change. The extent that anthropogenic electromagnetic radiation represents a significant threat to insect pollinators is unresolved and plausible.” (Balmori 2021)

Up until recently, the range of frequencies used for wireless communication has not risen above 6 GHz (2G, 3G, 4G, and WiFi). The impending deployment of the new and highly anticipated 5G technology utilizes a signal of 120 GHz. Research on insects showed that as the power density of frequencies above 6 GHz increased, the power absorbed by the invertebrates studied increased from three to 370 percent (Thielens et. al. 2018) making the importance of being able to understand the potential threat to pollinators from electromagnetic radiation all the more urgent.

Worker Bee Exposure

While lots of research documents the impacts of EMF on insects generally, some studies have looked at the impacts of electromagnetic radiation on honey bees and the majority of the papers have found potential cause for concern when honey bees are exposed to EMFs. Such exposure has been shown to cause significant cognitive impairment and behavioral changes. These include reduced locomotion activity, impaired homing and orientation abilities, fewer foraging flights and short-term memory loss. (Harst et. al. 2006; Warnke 2007; Kimmel et. al. 2007; Sharma and Kumar 2010; Shepherd et. al. 2018; Lopatina et. al. 2019; Shepherd et. al. 2019) Many of these studies, and others,



Honey bees and wild pollinators like this sweat bee pictured, are among the many insects that can be negatively affected by man-made sources of electromagnetic radiation.

document increased aggression when bees are exposed to EMR. (Mixson et. al. 2009; Halabi et. al. 2014).

Meanwhile, in 2017 researchers found that DNA damage in honey bee larvae increased significantly when exposed to modulating EMR fields. Exposure levels during the trial were much higher than what honey bees in nature could reasonably be expected to encounter but the results suggest the need for further intensive research on all stages of honey bee development. (Vilić et. al. 2017)

Cell Phone Towers

Cell phone towers have been a focus of additional research, but unfortunately the few studies that have looked at the effect from cell phone towers suffer from small sample sizes.

Some studies have concluded that the effect of cell tower electromagnetic radiation on colonies placed directly under cell-phone towers is insignificant. (Mall and Kumar 2014, Patel and Mall 2019) However, these researchers placed colonies under the transmission antennae at the base of the tower where the radiation broadcast angle approaches zero degrees resulting in little-to-no radiation exposure.

One of the more realistic studies that looked at the impact of electromagnetic radiation (EMR) on hives exposed to cell phone tower emissions was done on the Eastern honey bee *Apis cerana*. (Taye 2017) Foraging behavior was observed in colonies placed at distances of 100 meters, 200m, 300m, 500m, and 1000m from a cell phone tower. Researchers documented significantly reduced colony foraging activity in the hives closest to the radiation source. Clearly more research is needed on impacts of cell towers before firm conclusions can

be drawn on exactly how and under what circumstances cell phone towers may be harmful to bees and other pollinators.

Next month in part two of this article, we will look at the effects of RF-EMR on queens and share some ideas on what we as beekeepers might do to help reduce exposure to our bees and ourselves. 

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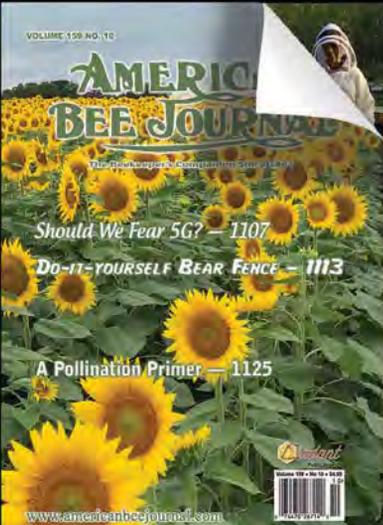
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To Whom It May Concern:

Dear Sirs/Madams:

I am Scientist Emeritus and Former Director of the National Institute of Environmental Health Sciences and National Toxicology Program of the National Institutes of Health. I am currently a Scholar in Residence at the Nicholas School of the Environment at Duke University.

Wireless networks, cell towers and cell phones create radiofrequency radiation emissions. U.S. FCC limits for human exposure to radiofrequency were last reviewed in 1996 and based on the assumption that heating is the only harmful effect. Aware that the FCC's 1996 limits lacked the underpinning of solid scientific data regarding long term health effects, the FDA requested large-scale studies by the National Toxicology Program (NTP) and in 2018 the NTP studies found clear evidence of an association with cancer in male rats. Additionally, the NTP found heart damage and DNA damage, despite the fact that the animals were carefully exposed to non-heating RFR levels long assumed to be safe. The Ramazzini Institute animal studies used even lower RFR lower exposures to approximate cell tower emissions and also found increases of the same tumor type. The NTP studies were carefully controlled to ensure exposures did not significantly heat the animals. The animal study findings in combination with human studies indicate adverse effects from non heating levels of radiofrequency.

I document the importance of the NTP findings of effects from non thermal exposures in my declaration in [an Amicus Brief](#) for the case Environmental Health Trust et al v. the FCC. The August 13, 2021 judgment ordered the FCC to address several issues including the health implications of long term exposures.

A mounting body of published studies associates radiofrequency radiation with adverse negative health effects. FCC limits need to be strengthened to protect the public, especially children and vulnerable populations, from long term exposures.

Linda S. Birnbaum, PhD
Scientist Emeritus and Former Director
National Institute of Environmental Health Sciences and National Toxicology Program
Scholar in Residence, Duke University, Former President, Society of Toxicology
Adjunct Professor, Yale University and UNC, Chapel Hill, Visiting Professor, Queensland University (Australia)

National Toxicology Program Radiofrequency Radiation
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Massachusetts Joint Committee on Consumer Protection
Massachusetts Joint Committee on Advanced Information Technology, the Internet and Cybersecurity Committee
24 Beacon St. Room 506
Boston, MA 02133

Subject: In Support of Technology Safety Bills S. 186, S. 187, H. 115, H. 105-114

Dear Esteemed Legislators,

I am writing in support of legislation that which reduces RFR exposure, especially for children who are more vulnerable.

I am Professor Emeritus of Pediatrics and of Environmental & Occupational Health George Washington University School of Medicine and Health Sciences and George Washington University Milken Institute School of Public Health. I am also past chair of the Council on Environmental Health of the American Academy of Pediatrics, and also served on the Children's Health Protection Advisory Committee for the US EPA.

We assume that our federal health and environmental agencies regularly review the latest research and ensure that cell phones and wireless devices are safe. However, U.S. agencies which regulate cell phone radiation have not shown they have evaluated the research on children's unique vulnerability to ensure long term safety.

The reality is that US safety regulations for cell phone radiation were last set twenty-five years ago based on science that is now outdated. The Federal Communications Commission (FCC) is the primary agency responsible for regulating wireless radiation. The FCC has no expertise related to human health topics. Moreover, federal agencies like the Environmental Protection Agency or the National Cancer Institute or the Food and Drug Administration have not carried out up-to-date full scientific review of this growing technology. Just like the thousands of chemicals in our environment today, wireless radiation has not had appropriate oversight. It has slipped through the cracks.

The one agency which has carried out studies on the impact of long term exposure to electromagnetic fields and human health is the National Toxicology Program (NTP), a component of the National Institute of Environmental Health Sciences. The [NTP found](#):

- **Clear evidence of an association with tumors in the hearts of male rats.** The tumors were malignant schwannomas.
- **Some evidence of an association with tumors in the brains of male rats.** The tumors were malignant gliomas.
- **Some evidence of an association with tumors in the adrenal glands of male rats.** The tumors were benign, malignant, or complex combined pheochromocytoma.

Pediatricians have long [called](#) for an update to this outdated cell phone radiation test method because research finds children can absorb up to 10 or more times [higher wireless radiation](#) than adults into their brain, eyes and bone marrow. Children are not little adults. As we sadly learned with early childhood lead exposures leaving long-lasting impairments, the developing brain is particularly [susceptible](#). Unlike my generation, today's youth will be exposed for years and years.

Please support legislation that reduces children's radiofrequency radiation exposure and call on the federal government to strengthen human exposure limits to protect children. I am glad to answer any questions that you have.

Sincerely,



Jerome Paulson MD FAAP



January 28, 2021

Chairman Don Serotta
Town of Chester
1786 Kings Highway
Chester, NY 10918

Dear Chairman Don Serotta,

Cell antennas and cell towers should not be placed near schools and homes.

On August 13, 2021, the United States Court of Appeals for the District of Columbia Circuit [ruled in our case](#) against the FCC that the decision by the Federal Communications Commission (FCC) to retain its 1996 safety limits for human exposure to wireless radiation (which includes cell tower emissions) was “arbitrary and capricious.” One of the important aspects of the court decision was that the ruling found the FCC did not adequately explain why it ignored the impacts of long term wireless exposure, especially for children, who are more vulnerable to wireless radiation. This [ruling](#) highlights how no federal health agency has reviewed the full body of research to develop proper safety standards.

Extensive published scientific evidence indicates that radiofrequency radiation *at levels far below FCC limits* can cause [cancer](#), [increased oxidative stress](#), [genetic damage](#), structural and functional changes of the [reproductive system](#), [memory deficits](#), [behavioral problems](#), and [neurological impacts](#). We consider radiofrequency radiation (RFR) to be a human carcinogen based on the [current body](#) of evidence.

At this time we have not identified a safe level of exposure. Although radiation levels decrease as you increase your distance from a particular antenna/tower, the reality is that adding a tower or base station to a community will definitely *increase* the radiation exposure in that area and at any distance within the surrounding coverage area.

We recommend policies to reduce human exposure to RFR, especially for children. Schools are where children spend the majority of their daytime hours. Therefore we strongly recommend against installing cell towers near schools, daycares, parks, homes, or hospitals.

Recent research on people living near cell antennas has found increases in molecular markers in the blood that predict cancer. This study evaluated effects in the human blood of individuals living near mobile phone base stations (for study purposes, they chose a distance of 80 meters) compared with healthy controls living more than 300 meters from a base station. The study measured higher RFR levels in the homes of people living in homes within 80 meters from the cell antennas (documenting the impact of increased RFR radiation from the antenna installations) and found statistically significant differences in their blood. The group living closer to the antennas had statistically significant higher frequency of micronuclei and a rise in lipid peroxidation in their blood; these changes are considered biomarkers predictive of cancer ([Zothansiana et al, 2017](#)).

Please note the following facts about cell towers and cell phone radiation:

- In 2011, radiofrequency radiation was [classified](#) as a Class 2B possible carcinogen by the World Health Organization's International Agency for Research on Cancer. Between then and now, the published peer-reviewed scientific evidence has significantly increased. Now, many scientists are of the opinion that the weight of current peer-reviewed evidence supports the conclusion that radiofrequency radiation should be regarded as a human carcinogen ([Hardell and Carlberg 2017](#), [Peleg et al, 2018](#), [Miller et al 2018](#)).
- The US National Toxicology Program \$25 million animal study on long-term exposure to radiofrequency radiation found [DNA Damage, heart damage, increased brain tumors, and increased heart tumors](#) deemed "clear evidence of cancer." Importantly, this study was launched almost two decades ago by the FDA because the US government had not performed research on the long-term effects of RFR exposure and the FDA wanted data on long-term safety. In 1996, the EPA was defunded from developing proper safety standards, and since then there has been no systematic review of the science by any US agency.
- Researchers with the renowned Ramazzini Institute in Italy published [findings](#) that lab animals exposed to levels of RFR below FCC limits developed the same types of cancerous cancers as the [US National Toxicology Program](#) found in their large-scale animal study.
- An Australian [study](#) looked at RFR levels to which kindergarten children were exposed, depending on how close their school was to base stations/cell towers. Researchers equipped the children with RFR measuring devices. Researchers found that kindergartens located nearby base stations/cell towers (closer than 300 meters or approximately 330 yards) had total exposure to radiofrequency radiation (RFR or RF-EMF) more than 3 times higher than children at schools where base stations were further away than 300 meters.
- A 2018 [study](#) measured radiofrequency radiation exposures in the environment including emissions from cell phone towers, TV and FM radio broadcast antennas, cell phone

handsets, and Wi-Fi—in several countries including the United States. The researchers concluded that cell phone tower (base station) radiation emissions are the dominant contributor to RFR exposure in most outdoor areas.

- A 2015 review found that in 93 out of 100 studies, RFR exposure caused oxidative stress ([Yakymenko 2015](#)). A 2021 review again confirmed non ionizing radiation has oxidative effects ([Schuermann 2021](#)). Many well-known causes of cancer in humans (such as asbestos and arsenic) are understood to induce oxidative stress.
- Studies also show that when combined with lead or a known carcinogen, RFR has magnified the carcinogen's effects. For example, RFR at levels far below FCC limits more than doubled the numbers of liver and lung tumors in carcinogen-exposed mice ([Lerchl 2015](#)).
- The International Association of Firefighters has officially opposed cell towers on their stations since 2004 after a study [found](#) neurological damage in firefighters with antennas on their fire station. In 2017, when 5G “small cells” were coming to California via a 5G streamlining bill (SB 649), firefighter organizations came out in strong opposition to the bill and requested that towers not be installed on firehouses. They were successful and SB649 was [amended](#) to [exempt](#) their stations from the deployment due to their health concerns.
- Published research finds the frequencies impact wildlife. For example, studies have found that the radiation alters bird navigation and disturbs honeybee colonies. Research also shows adverse impacts on trees and plants. ([Research on EMF and Bees](#), [Research on Wildlife](#) [Research on Trees](#))
- A 2019 [study](#) of students in schools near cell towers found their higher RF exposure was associated with impacts on motor skills, memory, and attention ([Meo 2019](#)). Examples of other effects linked to cell towers in research studies include [neuropsychiatric problems](#), [elevated diabetes](#), [headaches](#), [sleep problems](#), and [genetic damage](#). Such research continues to accumulate after the 2010 landmark [review study](#) on 56 studies that reported biological effects found at very low intensities of wireless radiation, including impacts on reproduction, permeability of the blood-brain barrier, behavior, cellular changes, and metabolic changes, and increases in cancer risk ([Lai and Levitt 2010](#)).
- The [International EMF Scientist Appeal](#) was submitted to the United Nations urging immediate protective policy action in light of the scientific evidence that has found adverse biological effects from electromagnetic radiation, including radiofrequency radiation, and, as of January 2019, this Appeal is signed by 247 scientists from 42 nations; these are scientists who have published peer-reviewed articles about electromagnetic fields. They state, “numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines. Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being.”

The exposure limits of the US Federal Communications Commission are totally outdated and do not protect the health of the public, especially not the health of children. The Los Angeles School District has banned cell towers on their District's school grounds.

Please note that in several countries, governments have set policies to protect children, pregnant women, and medically fragile persons by classifying areas with homes, hospitals, and schools as "sensitive areas." Some examples include:

- In India the government has set RFR limits to 1/10th of ICNIRP and the Brihanmumbai Municipal Corporation, Zilla Parishad, Rajasthan, and Mumbai have banned cell antenna/tower installations on schools.
- Greece has banned the installation of mobile phone base stations at the premises of schools, kindergartens, hospitals, or eldercare facilities.
- Chile's "Antenna Law" prohibits cell antennas/towers in "sensitive areas" (educational institutions, nurseries, kindergartens, hospitals, clinics, nursing homes).
- Several countries have [lower allowable RFR limits](#) in "sensitive" areas.

EHT's position is that children require special protections from radiofrequency radiation and their exposures should be reduced to as low as possible. We strongly recommend against cell tower/antenna placements at schools or near homes as this would increase daily RFR exposure.

Please feel free to contact us with more questions.

Sincerely,

Devra Davis, PhD, MPH
President and Founder, Environmental Health Trust
Visiting Professor, Hebrew University Hadassah Medical Center
<https://ehtrust.org>

Anthony B. Miller, MD
Professor Emeritus at the Dalla Lana School of Public Health, University of Toronto
Senior Advisor to Environmental Health Trust

Dr. Hugh Scully Testimony to the City of Toronto

(Past-President of Ontario Medical Association, Past-President of Canadian Medical Association, Past-President of Canadian Cardiovascular Society.)

As a physician leader in Canada with a great commitment to the health of Canadians, I am very concerned about the increasing evidence internationally that EMR is creating increasing health problems in our population as its use increases exponentially. This is particularly true among children and young Canadians, and teachers and nurses who are continuously exposed to WiFi routers in schools [and hospitals].

As a cardiac specialist, I am concerned that approximately 20% of people have detrimental cardiac rhythm sensitivity to EMR.

This issue is under active consideration by the Health and Public Policy Committee of the Royal College of Physicians and Surgeons of Canada, the Health Policy and Public Health Committees of the Canadian Medical Association and the Council of Family Physicians of Canada, the Canadian Pediatric Society and the Canadian Cardiovascular Society.

There is an abundance of evidence from around the world that EMR can be harmful to health. Many countries...not Canada or the United States...have initiated policies to mitigate the risks. We, in Canada, need to do the same or more.

It is imperative that City of Toronto does not install WiFi's in public parks and spaces. I ask you to vote against Councillor Matlow's proposal.

Sincerely,

Dr. Hugh Scully, BA,MD,MSc,FRSC[C],FACS

Professor of Surgery and Health Policy, University of Toronto, Past-President, OMA, CMA, CCS, Former Member of Council [Board], RCPSC and WMA, Member, Health Policy Advisory Council, American College of Surgeons.

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December 12, 2015

Montgomery County Schools
Carver Educational Services Center
850 Hungerford Drive
Rockville, MD 20850

cc Montgomery County City Council

Dear Montgomery County School District,

I am a pediatric neurologist and neuroscientist on the faculty of Harvard Medical School and on staff at the Massachusetts General Hospital. I am Board Certified in Neurology with Special Competency in Child Neurology, and Subspecialty Certification in Neurodevelopmental Disorders.

I have an extensive history of research and clinical practice in neurodevelopmental disorders, particularly autism spectrum disorders. I have published papers in brain imaging research, in physiological abnormalities in autism spectrum disorders, and in environmental influences on neurodevelopmental disorders such as autism and on brain development and function.

A few years ago I accepted an invitation to review literature pertinent to a potential link between Autism Spectrum Disorders and Electromagnetic Frequencies (EMF) and Radiofrequency Radiation(RFR). I set out to write a paper of modest length, but found much more literature than I had anticipated to review. I ended up producing a 60 page single spaced paper with over 550 citations. It is available at http://www.bioinitiative.org/report/wp-content/uploads/pdfs/sec20_2012_Findings_in_Autism.pdf and it was published in a revised and somewhat shortened form in two parts in the peer reviewed indexed journal *Pathophysiology* (2013) with the title: "Autism and EMF? Plausibility of a pathophysiological link." Please also see the appendix to this letter which contains a summary of this material and includes substantial scientific citations.

More recently I published an article entitled "[Connections in Our Environment: Sizing up Electromagnetic Fields.](#)" in *Autism Notebook Spring 2015* edition in which I summarized and personalized the information in the . In this article I describe how here is a whole series of problems at the cellular, sub-cellular and metabolic levels and immune levels that have been identified in autism. And interestingly, for every single one of those problems, there's literature about how EMFs can create those kinds of problems.

The argument I made in these articles is not that EMF is proven to cause autism, but rather, that EMF can certainly contribute to degrading the physiological integrity of the system at the cellular and molecular level" – and this in turn appears to contribute to the pathogenesis/causation not only of autism but of many highly common chronic illnesses, including cancer, obesity, diabetes and heart disease.. Please see this article on page 24-25 at the link <http://virtualpublications.soloprinting.com/publication/?i=252361>

In fact, there are thousands of papers that have accumulated over decades –and are now accumulating at an accelerating pace, as our ability to measure impacts become more sensitive – that document adverse health and neurological impacts of EMF/RFR. Children are more vulnerable than adults, and children with chronic illnesses and/or neurodevelopmental disabilities are even more vulnerable. Elderly or chronically ill adults are more vulnerable than healthy adults.

Current technologies were designed and promulgated without taking account of biological impacts other than thermal impacts. We now know that there are a large array of impacts that have nothing to do with the heating of tissue. The claim from wifi proponents that the only concern is thermal impacts is now definitively outdated scientifically.

Radiofrequency electromagnetic radiation from wifi and cell towers can exert a disorganizing effect on the ability to learn and remember, and can also be destabilizing to immune and metabolic function. This will make it harder for some children to learn, particularly those who are already having learning or medical problems in the first place. And since half of the children in this country have some kind of chronic illness, this means that a lot of people are more vulnerable than you might expect to these issues.

Powerful industrial entities have a vested interest in leading the public to believe that EMF/RFR, which we cannot see, taste or touch, is harmless, but this is not true. Please do the right and precautionary thing for our children.

I urge you to opt for wired technologies in Montgomery County classrooms, particularly for those subpopulations that are most sensitive. It will be easier for you to make a healthier decision now than to undo misguided decisions later.

Thank you.



Martha Herbert, PhD, MD

Selected pertinent publications

[Connections in our Environment: Sizing up Electromagnetic Fields](#) by M.R. Herbert (published in Autism Notebook Spring 2015, pp. 24-25) reviews in two pages key points of the more technical Herbert & Sage Autism-EMF paper

Herbert, M.R. and Sage, C. "Autism and EMF? Plausibility of a Pathophysiological Link". [Part 1: Pathophysiology, 2013, Jun;20\(3\):191-209](#), epub Oct 4, PMID 24095003. [Pubmed abstract for Part 1](#). [Part II: Pathophysiology, 2013 Jun;20\(3\):211-34](#). Epub 2013 Oct 8, PMID 24113318. [Pubmed abstract for Part II](#).

APPENDIX: MORE DETAILED SUMMARY OF THE PATHOPHYSIOLOGY

I became interested in the health and brain effects of electromagnetic frequency (EMF) and radiofrequency radiation (RFR) exposures in relation to my brain research because I was interested in how such exposures might alter brain function. In order to familiarize myself in more detail existing literature on the pathophysiological impacts of EMF/RFR, I coauthored a 40,000 word chapter in the 2012 update of the Bioinitiative, ¹ and published an updated 30,000 word version of that paper ("Autism and EMF? Plausibility of a Pathophysiological Link") in 2013 in two parts in the peer reviewed journal *Pathophysiology*. ^{2,3} My intention was to assess the plausibility of an association between increasing incidence of autism spectrum disorder and increasing EMF/RFR exposures. Rather than directly address the epidemiological issues, I looked at the parallels between the pathophysiological features documented in autism and the pathophysiological impacts of EMF/RFR documented in the peer-reviewed published scientific literature.

I will include here a brief summary of the paper (prepared for a lay audience) of the features of EMF/RFR that I reviewed (with citations at the end of this letter):

- EMF/RFR stresses cells. It lead to cellular stress, such as production of heat shock proteins, even when The EMF/RFR isn't intense enough to cause measurable heat increase. ⁴⁻⁶
- EMF/RFR damages cell membranes, and make them leaky, which makes it hard for them to maintain important chemical and electrical differences between what is inside and outside the membrane. This degrades metabolism in many ways – makes it inefficient. ⁷⁻¹⁵
- EMF/RFR damages mitochondria. Mitochondria are the energy factories of our cells. Mitochondria conduct their chemical reactions on their membranes. When those membranes get damaged, the mitochondria struggle to do their work and don't do it so well. Mitochondria can also be damaged through direct hits to steps in their chemical assembly line. When mitochondria get inefficient, so do we. This can hit our brains especially hard, since electrical communication and synapses in the brain demands huge amounts of energy.
- EMF/RFR creates "oxidative stress." Oxidative stress is something that occurs when the system can't keep up with the stress caused by utilizing oxygen, because the price we pay for using oxygen is that it generates free radicals. These are generated in the normal course of events, and they are "quenched" by antioxidants like we get

in fresh fruits and vegetables; but when the antioxidants can't keep up or the damage is too great, the free radicals start damaging things.

- EMF/RFR is genotoxic and damages proteins, with a major mechanism being EMF/RFR-created free radicals which damage cell membranes, DNA, proteins, anything they touch. When free radicals damage DNA they can cause mutations. This is one of the main ways that EMF/RFR is genotoxic – toxic to the genes. When they damage proteins they can cause them to fold up in peculiar ways. We are learning that diseases like Alzheimer's are related to the accumulation of mis-folded proteins, and the failure of the brain to clear out this biological trash from its tissues and fluids.
- EMF/RFR depletes glutathione, which is the body's premier antioxidant and detoxification substance. So on the one hand EMF/RFR creates damage that increases the need for antioxidants, and on the other hand they deplete those very antioxidants.^{1,16}
- EMF/RFR damages vital barriers in the body, particularly the blood-brain barrier, which protects the brain from things in the blood that might hurt the brain. When the blood-brain barrier gets leaky, cells inside the brain suffer, be damaged, and get killed.^{1,16,17}
- EMF/RFR can alter the function of calcium channels, which are openings in the cell membranes that play a huge number of vital roles in brain and body.¹⁸⁻²⁷
- EMF/RFR degrades the rich, complex integration of brainwaves, and increase the "entropy" or disorganization of signals in the brain – this means that they can become less synchronized or coordinated; such reduced brain coordination has been measured in autism.²⁸⁻⁴⁰
- EMF/RFR can interfere with sleep and the brain's production of melatonin.⁴¹⁻⁴³
- EMF/RFR can contribute to immune problems.⁴⁴⁻⁵⁰
- EMF/RFR contribute to increasing stress at the chemical, immune and electrical levels, which we experience psychologically.^{51-57 17, 58-62 63-68}

Please note that:

1. There are a lot of other things that can create similar damaging effects, such as thousands of "xenobiotic" substances that we call toxicants. Significantly, toxic chemicals (including those that contain naturally occurring toxic elements such as lead and mercury) cause damage through many of the same mechanisms outlined above.
2. In many of the experimental studies with EMF/RFR, damage could be diminished by improving nutrient status, particularly by adding antioxidants and melatonin.⁶⁹⁻⁷²

I understand that the concept of electromagnetic hypersensitivity is not always well understood in the medical and scientific communities. Indeed, the inter-individual variability is perplexing to those who would expect a more consistent set of features.

But given the range of challenges I have listed that EMF/RFR poses to core processes in biological systems, and given the inter-individually variable vulnerability across these symptoms, it is really not surprising that there would be subgroups with different combinations of symptom clusters.

It also appears to be the case that the onset and duration of symptoms or even brain response to EMR/RFR can be variable. This again is to be expected given the mediation of these symptoms through a variety of the above-listed pathophysiological processes, many of which differ in scale (ranging from molecular to cellular to tissue and organ) and time course of impact. The different parts of the body also absorb this energy differently, both

because of their biophysical properties and as a function of their state of health or compromise thereof.

Here is a list of subgroups of symptom clusters identified by a group of German physicians, that exemplifies these variability issues:

- Group 1** no symptoms
- Group 2** sleep disturbance, tiredness, depressive mood
- Group 3** headaches, restlessness, dazed state, irritability, disturbance of concentration, forgetfulness, learning difficulties, difficulty finding words
- Group 4** frequent infections, sinusitis, lymph node swellings, joint and limb pains, nerve and soft tissue pains, numbness or tingling, allergies
- Group 5** tinnitus, hearing loss, sudden hearing loss, giddiness, impaired balance, visual disturbances, eye inflammation, dry eyes
- Group 6** tachycardia, episodic hypertension, collapse
- Group 7** other symptoms: hormonal disturbances, thyroid disease, night sweats, frequent urge to urinate, weight increase, nausea, loss of appetite, nose bleeds, skin complaints, tumors, diabetes

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3 August 2016

Petaluma City Schools
District Office
200 Douglas Street
Petaluma, California 94952

Dear Sirs/Madams:

I am a public health physician who served as the Co-Editor of the Bioinitiative Report, published in 2007 as a comprehensive review of the adverse health effects of radiofrequency electromagnetic fields.

There is strong and consistent evidence that excessive exposure to radiofrequency electromagnetic fields has adverse human health effects. Of particular concern is the clear evidence that children are more vulnerable than adults. The best-documented adverse effects are an increase in risk of cancer, but cancers do not appear immediately upon exposure but rather come years later. The National Toxicology Program has within the past couple of months reported that even rats exposed to radiofrequency radiation develop brain cancer! Within a school setting there is increasing evidence that excessive exposures reduce learning ability, which is the last thing one wants in a school. Some children will also develop a syndrome of electrohypersensitivity, where they get headaches and reduced ability to pay attention and learn. While these effects are not nearly as well documented as those relating to cancer, they are particularly important within a school. This is especially the case in a wireless computer classroom, where exposure can be very high. However there will be essentially no exposure in a wired computer classroom.

The exposure levels of the Federal Communications Commission are totally outdated and do not protect the health of the public, especially of children. I urge you to abandon any plans for wireless communication within schools. It is of course critical that all children have access to the Internet, but when this is done through wired connections they will not be exposed to excessive electromagnetic fields.

Yours sincerely,



David O. Carpenter, M.D.
Director, Institute for Health and the Environment
University at Albany

District Office
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 94952
 USA

4 August, 2016

Dear Petaluma City Schools;
 Superintendent Gary Callahan and Board of Trustees

Regarding: Wireless technology should not be used in schools or pre-schools due to health risks for children and employees

We have been asked to declare our opinion about wireless technology in schools by parents that are concerned about their children.

Based on current published scientific studies, we urge your administration to educate themselves on the potential risks from wireless technologies in schools, and to choose wired teaching technologies. The well-being and educational potential of children depends on it.

High-speed connectivity to schools is important but it can be a wired connection instead of Wi-Fi. Wireless classroom infrastructure and wireless devices for schoolchildren should be avoided for these reasons:

- Wireless radiofrequency (RF) radiation emissions were classified as a Possible Human Carcinogen (group 2B) by the World Health Organization International Agency for Research on Cancer (IARC) in May 2011. One of the signers, Dr Hardell, was part of the evaluation group.
- The IARC classification holds for *all forms of radio frequency radiation* including RF-EMF emissions from wireless transmitters (access points), tablets and laptops.
- Epidemiological studies show links between RF radiation exposure and cancer, neurological disorders, hormonal changes, symptoms of electrical hypersensitivity (EHS) and more. Laboratory studies show that RF radiation exposure increases risk of cancer, abnormal sperm, learning and memory deficits, and heart irregularities. Foetal exposures in both animal and human studies may result in altered brain development in the young offspring, with disruption in learning, memory and behaviour.
- Recently a report was released from The National Toxicology Program (NTP) under the National Institutes of Health (NIH) in USA on the largest ever animal study on cell phone RF radiation and cancer (<http://biorxiv.org/content/biorxiv/early/2016/05/26/055699.full.pdf>). An increased incidence of glioma and malignant schwannoma in the heart was found. Interestingly our research group and others have in epidemiological studies shown that persons using wireless phones (both mobile phones and cordless phones; DECT) have an increased risk for glioma and acoustic neuroma. Acoustic neuroma or vestibular schwannoma is the same type of tumour as the one found in the heart, although benign.
- The research showing increased brain cancer risk in humans *has strengthened* since the IARC 2011 classification as new research has been published which repeatedly shows a significant association after RF radiation exposure. In addition, tumour

promotion studies have now been replicated showing cancer promotion after exposures at low levels.

- It is our opinion and that of many colleagues that the current IARC cancer risk classification should move to an *even higher* risk group. The carcinogenic effect has been shown in human and animal studies. Several laboratory studies have shown mechanistic effects in carcinogenesis such as oxidative stress, down regulation of mRNA, DNA damage with single strand breaks.
- In summary RF radiation should be classified as Carcinogenic to Humans, Group 1 according to the IARC classification. This classification should have a major impact on prevention.

The evidence for these statements is based on hundreds of published, peer-reviewed scientific studies that report adverse health effects at levels much lower than current ICNIRP and FCC public safety limits. Compliance with government regulations does not mean that the school wireless environment is safe for children and staff (especially pregnant staff).

As researchers in cancer epidemiology and RF radiation exposures, we have published extensively in this area and it is our opinion that schools should choose wired Internet connections. Multiple epidemiological research studies show that exposures equivalent to 30 minutes a day of cell phone use over ten years results in a significantly increased brain cancer risk.

What will be the health effect for a child exposed all day long in school for 12 years? Wireless networks in schools result in full body low level RF radiation exposures that can have a cumulative effect on the developing body of a child. No safe level of this radiation has been determined by any health agency and therefore we have no safety assurances. Cancers can have long latency periods (time from first exposure until diagnosis) and it will take decades before we know the full extent of health impacts from this radiation. The statistics and effects will be borne by the children you serve.

Wi-Fi in schools, in contrast to wired Internet connections, will increase risk of neurologic impairment and long-term risk of cancer in students. Promoting wireless technology in schools disregards the current health warnings from international science and public health experts in this field.

We recommend that your school district install wired Internet connections and develop curriculum that teaches students at all ages safer ways to use their technology devices. If cell phones and other wireless devices are used in the school curriculum (as many schools are now doing with Bring your Own Device Policy) then there should be educational curriculum in place and well posted instructions in classrooms so that the students and staff use these devices in ways that reduce exposure to the radiation as much as possible.

Supporting wired educational technologies is the safe solution in contrast to potentially hazardous exposures from wireless radiation.

Respectfully submitted

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Dr. Anthony B. Miller

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August 4, 2016

Petaluma City Schools
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Re: Adverse Effects of Radiofrequency fields

I am writing to express my concern over the increasing exposure of children in schools to Radiofrequency Fields (e.g. from wi-fi, as required for cell phones and iPads, and emitted by cell towers) and the lack of concern expressed by many councils, governments and School Boards on this issue. In particular, justification for the “safety” of radiofrequency fields is placed upon the use of outdated safety standards, based upon tissue heating, whereas it has now been well demonstrated that adverse biological effects occur at far lower levels of radiofrequency fields that do not induce tissue heating, including a recent animal study performed by the National Toxicology Program in the United States which found an increased incidence of brain cancers and other cancers in rats exposed to prolonged Radiofrequency fields.

I am a physician and epidemiologist specializing in cancer etiology, prevention, and screening, expert in epidemiology, and particularly causes of human cancer. I have performed research on ionizing radiation and cancer, electromagnetic fields and cancer, and have served on many committees assessing the carcinogenicity of various exposures, including working groups of the International Agency for Research on Cancer (IARC), widely regarded as providing unbiased assessment on the carcinogenicity of chemicals and other exposure to humans.

In 2011, an IARC working group designated radiofrequency fields as a class 2B carcinogen, a possible human carcinogen. Since that review a number of additional studies have been reported. One of the most important was a large case-control study in France, which found a doubling of risk of glioma, the most malignant form of brain cancer, after two years of exposure to cell phones. After five years exposure the risk was five-fold. They also found that in those who lived in urban environments the risk was even higher. In my view, and that of many colleagues who have written papers on this issue, these studies provide evidence that radiofrequency fields are not just a possible human carcinogen but a probable human carcinogen, i.e. IARC category 2A. It would be impossible to ignore such an assessment in regulatory approaches.

It is important to recognize that there are no safe levels of exposure to human carcinogens. Risk increases with increasing intensity of exposure, and for many carcinogens, even more with increasing duration of exposure. The only way to avoid the carcinogenic risk is to avoid exposure altogether. This is why we ban known carcinogens from the environment and why much effort is taken to get people, particularly young people, not to smoke. We now recognize that exposure to carcinogens in childhood can increase the risk of cancer in adulthood many years later. Further, people vary in their genetic makeup, and certain genes can make some people more susceptible than others to the effect of carcinogens. It is the young and those who are susceptible we should protect.

As an epidemiologist who has done a great deal of work on breast cancer, I have been concerned by a series of case reports from California and elsewhere of women who developed unusual breast cancers in the exact position where they kept cell phones in their bras. These are unusual cancers. They are multifocal, mirroring where the cell phone was kept. Thus in these relatively young women the radiofrequency radiation from very close contact with a cell phone has caused breast cancer.

Not only brain and breast cancers but parotid gland tumors, tumors of the salivary gland, have been associated with prolonged exposure to cell phones.

Given the long natural history of cancer and the fact that human populations have not been exposed for a sufficient length of time to reveal the full adverse effects of radiofrequency fields, it is extremely important to adopt a precautionary approach to the exposure of humans to such fields. An individual, if appropriately informed, can reduce her or his exposure to radiofrequency fields from devices that use wi-fi, but in the case of cell towers, smart meters and wi-fi in schools, the exposure they receive is outside their control. Then, with the people who manufacture these devices and those who promote wi-fi failing to issue adequate health warnings, we are reaching a situation where schools, work places and homes are being saturated with radiofrequency fields.

Thus to avoid a potential epidemic of cancer caused by radiofrequency fields from wi-fi and other devices, we should introduce means to reduce exposure as much as reasonably achievable, use hard wire connections to the internet and strengthen the codes that are meant to protect the public.

Yours sincerely

A handwritten signature in black ink, appearing to read 'A. B. Miller', written in a cursive style.

Anthony B. Miller, MD, FRCP(C), FRCP, FACE
Professor Emeritus
Dalla Lana School of Public Health, University of Toronto, Ontario, Canada



Karolinska Institutet
Department of Neuroscience
Experimental Dermatology Unit

Stockholm, December 8, 2015

To:

MCPS CEO Dr. Andrew Zuckerman [Andrew_Zuckerman@mcpsmd.org]
MCPS Superintendent Mr. Larry Bowers [Larry_Bowers@mcpsmd.org]
MCPS Chief Technology Officer Mr. Sherwin Collette [Sherwin_Collette@mcpsmd.org]
MCPS Board of Education [boe@mcpsmd.org]
840 Hungerford Drive
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cc:

Montgomery County Council [county.council@montgomerycountymd.gov]

Dear Madame or Sir,

My name is Olle Johansson, and I am an associate professor, heading the Experimental Dermatology Unit at Sweden's Karolinska Institute in the Department of Neuroscience. I understand you have recently made public pronouncements regarding the safety of Wi-Fi. As a neuroscientist who has been studying the biophysical and epidemiological effects of electromagnetic fields (EMFs) for over 30 years, I believe this designation is short-sighted.

Wireless communication is now being implemented in our daily life in a very fast way. At the same time, it is becoming more and more obvious that the exposure to electromagnetic fields not only may induce acute thermal effects to living organisms, but also non-thermal effects, the latter often after longer exposures. This has been demonstrated in a very large number of **non-ionizing radiation** studies and includes cellular DNA-damage, disruptions and alterations of cellular functions like increases in intracellular stimulatory pathways and calcium handling, disruption of tissue structures like the blood-brain barrier, impact on vessel and immune functions, and loss of fertility. Whereas scientists can observe and reproduce these effects in controlled laboratory experiments, epidemiological and ecological data derived from long-term exposures in well-designed case-control studies reflect this link all the way from molecular and cellular effects to the living organism up to the induction and proliferation of diseases observed in humans. It should be noted that we are not the only species at jeopardy; practically all animals, plants and bacteria may be at stake. Although epidemiological and ecological investigations as such never demonstrate causative effects, due to the vast number of confounders, they confirm the relevance of the controlled observations in the laboratories.

Many times since the early 1980s I have pointed out that the public's usage of cell phones has become the largest full-scale biological and medical experiment ever with mankind, and I was also the first person to firmly point out that this involuntary exposure violates the Nuremberg Code's principles for human experimentation, which clearly states that voluntary

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consent of human subjects is absolutely essential. Among many effects seen, the very serious one is the deterioration of the genome. Such an effect - if seen in a food item under development or in a potential pharmaceutical drug - immediately would completely ban it from further marketing and sale; genotoxic effects are not to be allowed or spread. For these reasons above, we, scientists, can not accept that children undergo an enormous health risk for their present and future, by being exposed to WI-FI in kindergardens or schools (even if the WI-FI masts/routers are not in the children's classroom). The precautionary principle has to be respected. Furthermore, when men place cell phones in their front pocket, or laptops on their laps, it should be noted that experimental studies have demonstrated that after similar exposures there is a decrease in sperm count as well as in the quality of sperm, which is a phenomenon that could affect society's overall ability to procreate in the future. Experiments in mice point to that it may be true already in 5 generations time.

Many other states including France, Russia, Israel and Germany, have employed various precautionary steps and their responses (including labelling cell phones and other transmitting devices with SAR ratings, discouraging the use of cell phones and other wireless gadgets by children, warning parents of the risks, and removing or restricting WiFi in schools and replacing it with hard-wired ethernet) as a result of the *WHO/IARC classification of radiofrequency electromagnetic radiation in 2011 as a Class 2B carcinogen as well as the earlier classification of power-frequent magnetic fields in 2001 also as a Class 2B carcinogen*, the information summarized in the Bioinitiative Reports of 2007 and 2012, and the other considerable international and independent research and reviews, that show adverse biological effects from electromagnetic fields, including heart palpitations, headaches, skin rashes, damage to DNA, mental health effects, impaired concentration, decreased problem-solving capacity, electrohypersensitivity, etc., are about to set a new standard for educational quality with due respect to children's and staff's health.

In the case of "protection from exposure to electromagnetic fields", it is thus of paramount importance to act from a prudence avoidance/precautionary principle point of view. Anything else would be highly hazardous. Total transparency of information is the key sentence here, as I believe the public does not appreciate having the complete truth revealed years after a certain catastrophe already has taken place. For instance, it shall be noted, that today's recommended values for wireless systems, such as the SAR-values, are just recommendations, and not safety levels. Since scientists observe biological effects at as low as 20 microWatts/kg, can it truly be stated that it is safe to allow irradiation of humans at SAR 2 W/kg, or at 100,000 times stronger levels of radiation?

IMBALANCED REPORTING

Another misunderstanding is the use of scientific publications (as the tobacco industry did for many years) as 'weights' to balance each other. But one can NEVER balance a report showing a negative health effect with one showing no effect. This is a misunderstanding which, unfortunately, is very often used both by the industrial representatives as well as official authorities to the detriment of the general public. True balance would be reports showing negative health effects against *exact replications* showing no or positive effects. However, this is not what the public has been led to believe.

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NEED FOR INDEPENDENT RESEARCH

In many commentaries, debate articles and public lectures - for the last 20-30 years – I have urged that completely independent research projects must be inaugurated immediately to ensure our public health. These projects must be entirely independent of all types of commercial interests; public health can not have a price-tag! It is also of paramount importance that scientists involved in such projects must be free of any carrier considerations and that the funding needed is covered to 100%, not 99% or less. This is the clear responsibility of the democratically elected body of every country.

WHO/INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC), 2011

Very recently (in Lyon, France, May 31, 2011) the WHO/International Agency for Research on Cancer (IARC) has classified radiofrequency electromagnetic fields as possibly carcinogenic to humans (Group 2B), based on an increased risk for glioma, a malignant type of brain cancer. This should be added to the previous (2001) 2B classification of power-frequent (ELF) electromagnetic fields – emitted at high levels from handheld gadgets, such as eReaders and mobile phones – as a risk factor for childhood leukemia. Given the 2001 very close votes (9 to 11) for moving it to 2A and all the new knowledge that has accumulated since 2001, today the association between childhood leukemia and power-frequent (ELF) electromagnetic fields would definitely be signed into the much more serious 2A (“probably carcinogenic”) category. So, the ‘red flag’ is – unfortunately – flying very high.

INVOLUNTARY EXPOSURE

According to Article 24 of the UNICEF’s Child Convention “children have the right to ... a clean and safe environment, and information to help them stay healthy”. We must all ensure that this article never is violated. This is about our social responsibility, and is very much a public health issue.

In summary, electromagnetic fields may be among the most serious and overlooked health issues today, and having these fields checked and reduced/removed from schools and kindergardens may be essential for health protection and restoration, and is a must for persons with the functional impairment electrohypersensitivity as for children who are more fragile (cf. Belyaev I, Dean A, Eger H, Hubmann G, Jandrisovits R, Johansson O, Kern M, Kundi M, Lercher P, Mosgöller W, Moshammer H, Müller K, Oberfeld G, Ohnsorge P, Pelzmann P, Scheingraber C, Thill R, "EUROPAEM EMF Guideline 2015 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses", Rev Environ Health 2015; 30: 337–371). In addition, as recently discussed in a think-tank group here in Stockholm, it is very important to constantly educate oneself and participate in the general debate and public discussions to keep the information build-up active. Thus, it is of paramount importance to keep the "kettle boiling", never blindly trusting or accepting given 'facts', but only read and think for yourself and for your loved ones. Only so you can arrive at a genuinely working precautionary principle.

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CONCLUSION

In conclusion, wireless systems, such as Wi-Fi routers or cell towers, and their electromagnetic fields, can not be regarded as safe in schools, but must be deemed highly hazardous and unsafe for the children as well as for the staff.

I encourage governments and local health and educational bodies to adopt a framework of guidelines for public and occupational EMF exposure that reflect the Precautionary Principle. As noted, the Precautionary Principle states when there are indications of possible adverse effects, though they remain uncertain, the risks from doing nothing may be far greater than the risks of taking action to control these exposures. The Precautionary Principle shifts the burden of proof from those suspecting a risk to those who discount it — as some nations have already done. Precautionary strategies should be based on design and performance standards and may not necessarily define numerical thresholds because such thresholds may erroneously be interpreted as levels below which no adverse effect can occur.

Some 100 years back, we learned the hard lessons of ionizing radiation and the need for strict health protections – now we must openly face the possibility that we must take a seat in life’s school and learn again. This time it is about non-ionizing radiation.

Based on all of the above, I strongly urge you to reconsider your public stance on the safety of Wi-Fi, cell towers, and similar systems in schools as their non-ionizing radiation emissions very likely are hazardous and unsafe for students, staff and teachers.

With my very best regards
Yours sincerely
Olle Johansson

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MCPS COO Dr. Andrew Zuckerman
MCPS Interim Superintendent Larry Bowers
MCPS Board of Education
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January 3, 2016

Dear Montgomery County COO Dr. Andrew Zuckerman, Interim Superintendent Larry Bowers,
Board of Education and Office of Technology;

I have been asked to comment on the [MCPS Statement Concerning Deployment of Wireless Computing Technologies](#). I am happy to do so.

The first paragraph in that statement is not relevant to the issue at hand because it is perfectly possible to use wired communication for such education. This document is being produced on a computer on which I only use wired communication, connecting to the internet, connecting to my printer and for other purposes, as well.

The 2nd and 3rd paragraphs of your statement may well be technically correct. However these give us no assurance whatsoever of safety of Wi-Fi fields. The FCC guidelines as are many other such guidelines, are based on the assumption that only heating effects of microwave/lower frequency EMFs can have biological effects. However that assumption has been falsified by thousands of studies published from the 1950s to the present, each showing that non-thermal levels of exposure often produce biological effects. For example, in 1971, the U.S. Office of Naval Medical Research produced a document reporting over 100 different non-thermal effects [1], listing 40 apparent neuropsychiatric changes produced by non-thermal microwave frequency exposures, including 5 central/peripheral nervous system (NS) changes, 9 central NS effects, 4 autonomic system effects, 17 psychological disorders, 4 behavioral changes and 2 misc. effects [1]. It also listed cardiac effects including ECG changes and cardiac necrosis as well as both hypotension and hypertension, and also 8 different endocrine effects.

Changes affecting fertility included tubular degeneration in the testis, decreased spermatogenesis, altered sex ratio, altered menstrual activity, altered fetal development, programmed cell death (what is now known as apoptosis) and decreased lactation. Many other non-thermal changes were also listed for a total of over 100 non-thermal effects. They also provided [1] approximately 2000 citations documenting these various health effects. That was almost 45 years ago and is only the beginning of the evidence for the existence of non-thermal effects. My own recent paper [2] shows that widespread neuropsychiatric effects are caused by non-thermal exposures to many different microwave frequency electromagnetic fields (EMFs).

Tolgskaya and Gordon [3] in 1973 published a long and detailed review of effects of microwave and lower frequency EMFs on experimental animals, mostly rodents. They report that non-thermal exposures impact many tissues, with the nervous system being the most sensitive organ in the body, based on histological studies, followed by the heart and the testis. They also report effects of non-thermal exposures on liver, kidney, endocrine and many other organs. The nervous system effects are very extensive and include changes many changes in cell structure, disfunction of synaptic connections between neurons and programmed cell death and are discussed in Refs. [2,3] and more modern studies reporting extensive effects of such non-thermal EMF exposures on the brain are also cited in [2]. There are also many modern studies showing effects of non-thermal exposures on fertility in animals.

The Raines 1981 National Aeronautics and Space Administration (NASA) report [4] reviewed an extensive literature based on occupational exposures to non-thermal microwave EMFs. Based on multiple studies, Raines [4] reports that 19 neuropsychiatric effects are associated with occupational microwave/ radiofrequency EMFs, as well as cardiac effects, endocrine including neuroendocrine effects and several other effects.

I reviewed many other scientific reviews on this topic, each of which clearly supports the view that there are various non-thermal health impacts of these EMFs [5]. In 2015, 206 international scientists signed [a statement](#) sent to the United Nations Secretary General and to member states, stating that international safety guidelines and standards are inadequate to protect human health [6]. Each of these 206 scientists from 40 countries had scientific publications on biological effects of such EMFs and therefore each is well qualified to judge this. ***It can be seen from this statement to the UN, that there is a strong scientific consensus that current safety guidelines and standards are inadequate because they do not take into consideration all of the non-thermal health effects produced by various EMF exposures.***

That scientific consensus also rejects, therefore, the FCC EMF guidelines, guidelines that cannot be defended despite your own attempt to do so in MCPS Statement Concerning Deployment of Wireless Computing Technologies.

It can be seen from the previous paragraphs, that the following non-thermal effects of EMF exposures are well documented:

- Ø Widespread neuropsychiatric effects
- Ø Several types of endocrine (that is hormonal) effects
- Ø Cardiac effects impacting the electrocardiogram (Note: these are often associated with occurrence of sudden cardiac death)
- Ø Male infertility

However, there are many additional types of biological changes produced by non-thermal EMF exposures (reviewed in 5,7] including:

- Ø Oxidative stress
- Ø Changes in calcium fluxes and calcium signaling
- Ø Several types of DNA damage to the cells of the body, including single strand and double strand DNA breaks and 8-OH-guanine in DNA
- Ø Cancer (which is undoubtedly caused, in part, by such DNA damage)
- Ø Female infertility
- Ø Lowered melatonin; sleep disruption
- Ø Therapeutic effects of EMFs when they are highly controlled and focused on a specific part of the body

It can be seen from the above, that each of the things that we most value as individuals and as a species are being attacked by non-thermal microwave frequency EMFs [5.7]:

§ **Our Health**

§ **Our brain function**

§ **The integrity of our genomes**

§ **Our ability to produce healthy offspring**

I want to emphasize that the specific health effects listed above are **not** the only things that are likely to be impacted by non-thermal EMF exposures, they are however the best documented such effects.

While it has been clear for many years that there are many non-thermal health effects of microwave frequency EMFs, it has not been clear until about 2 ½ years ago, how these effects are produced by such exposures. I stumbled onto the mechanism in 2012 and published on it in mid-2013. This 2013 paper [8] was honored by being placed on the Global Medical Discovery web site as one of the most important medical papers of 2013. At this writing, it has been cited 61 times according to the Google Scholar database, with over 2/3rds of those citations during 2015. So clearly it is having a substantial and rapidly increasing impact on the scientific literature. I have given 26 professional talks, in part or in whole on EMF effects in 10 different countries over the last 2 1/4 years. So it is clear that there has been a tremendous amount of interest in this research.

What the 2013 study showed [8], was that in 24 different studies (and there are now 2 more that can now be added [2]), effects of low-intensity EMFs, both microwave frequency and lower frequency EMFs could be blocked by calcium channel blockers, drugs that block what are called voltage-gated calcium channels (VGCCs). There were a total of 5 different types of calcium

channel blocker drugs used in these studies, with each type acting on a different site on the VGCCs and each thought to be highly specific for blocking VGCCs. What these studies tell us is that these EMFs act to produce non-thermal effects by activating the VGCCs. Where several effects were studied, when one of them was blocked or greatly lowered, each other effect studied was also blocked or greatly lowered. This tells us that the role of VGCC activation is quite wide – many effects go through that mechanism, possibly even all non-thermal effects in mammals. There are a number of other types of evidence confirming this mechanism of action of microwave frequency EMFs [2,]. Each of the 11 health impacts caused by non-thermal EMF exposures can be explained as being produced by indirect effects of VGCC activation [5,7].

It is now apparent [7] that these EMFs act directly on the voltage sensor of the VGCCs, the part of the VGCC protein that detects electrical changes and can open the channel in response to electrical changes. The voltage sensor (and this is shown on pp. 102-104 in [7]) is predicted, because of its structure and its location in the plasma membrane of the cell, to be extraordinarily sensitive to activation by these EMFs, about 7.2 million times more sensitive than are single charged groups elsewhere in the cell. What this means is that arguments that EMFs produced by particular devices are too weak to produce biological effects, are immediately highly suspect because the actual target, the voltage sensor of the VGCCs is extremely sensitive to these EMFs. **Because heating is mostly produced by forces on these singly charged groups elsewhere in the cell, limiting safety guidelines to heating effects means that these guideline allow exposures that are something like 7.2 million times too high.**

Why then does the FCC stick with these totally unscientific safety guidelines? That is the 64 billion dollar question. The FCC has been shown, in a long detailed document published by Harvard University Center for Ethics, to be a “captured agency”, that is captured by the telecommunications industry that the FCC is supposed to be regulating [9; can be obtained full text from web site listed in 9]. So perhaps the failure of the FCC to follow the extensive science in this important area, can be understood. Of course, what that means is that the FCC is completely failing in its role of protecting the public and it is a major blunder, therefore for either you or any other organization to depend on the FCC guideline as a reliable predictor of impacts of EMFs in humans.

So what is known about health impacts of Wi-Fi EMFs?

Table 1. The following Table summarizes various health impacts of Wi-Fi EMF exposures:

Citation(s)	Health Effects
[10,11,12,13,14,15,16]	Sperm/testicular damage, male infertility
[10,15,17,18,19,20]	Oxidative stress
[20]	Calcium overload

[11,12,20]	Apoptosis (programmed cell death)
[17]	Melatonin lowering; sleep disruption
[10,13]	Cellular DNA damage
[21]	MicroRNA expression (brain)
[18]	Disrupts development of teeth
[22]	Cardiac changes, blood pressure disruption; erythrocyte damage; catecholamine elevation
[23,24]	Neuropsych changes including EEG
[25]	Growth stimulation of adipose stem cells (role in obesity?)

Each of the effects reported above in 2 to 7 studies have an extensive literature for their occurring in response to various other microwave frequency EMFs so it should be clear that these observations on Wi-Fi exposures are highly probable to be correct. These include (see Table 1) findings that Wi-Fi exposures produce impacts on the testes leading to lowered male fertility; oxidative stress; intracellular calcium overload; apoptosis (a process that has an important causal role in neurodegenerative diseases); cellular DNA damage; neuropsychiatric changes including EEG changes. Each of these are very serious and oxidative stress has causal roles in many different human diseases; intracellular calcium overload has many different consequences – for example, it has a central role in causing neurodegenerative diseases; cellular DNA damage can cause cancer and produce mutations that impact future generations (if there are any). Other Wi-Fi effects each only documented by a single study are also effects where a variety of other non-thermal microwave EMFs also cause these, as shown by extensive literature on each of them. These include: melatonin lowering and sleep disruption; and the effects reported by Sali et al [22] cardiac changes, blood pressure disruption; erythrocyte damage; catecholamine elevation. So these may well be correct observations as well despite having only a single Wi-Fi specific study for each.

Summary:

1. The EMF safety guidelines supported by the FCC and others assume that only heating effects need be of concern. These assumptions have been known to be false for at least 45 years and there is a scientific consensus on this, that has led to the petition by 206 highly qualified international scientists to the UN stating that current safety guidelines are inadequate.
2. We now know that low intensity non-thermal exposures work via VGCC activation and that indirect effects of such VGCC activation can produce each of the health effects that have been widely reported to occur in response to such EMF exposures for something like 60 years.

These attack:

a. Our health

- b. Our brain function**
- c. The integrity of our genomes**
- d. Our ability to produce healthy offspring**

3. The voltage sensor of the VGCCs is stunningly sensitive to such low intensity EMFs, about 7.2 million times more sensitive than are singly charge groups elsewhere in our cells. The consequence of this is that safety guidelines allow exposures that are very roughly 7.2 million times too high.

4. The FCC has been shown, in a detailed Harvard University study, to be a Captured Agency, captured by the industry that it is supposed to be regulating. This provides an additional reason to be very highly skeptical about all FCC safety guidelines.

5. 15 studies have each shown health effects of Wi-Fi, most of which have also been shown to occur in response to low intensity exposures to other types of microwave frequency EMFs. These are likely to have massive health effects by producing male infertility (female infertility has not been studied in response to Wi-Fi), oxidative stress (involved in dozens of human diseases), cellular DNA damage (possibly leading to both cancer and mutations in future generations), life threatening cardiac effects, cellular apoptosis and also intracellular calcium overload (with both of these possibly leading to neurodegenerative diseases), various neuropsychiatric changes and many others.

It is my view that it is sheer insanity to fail to see the threat to our and to all human civilization by continuing to ignore the threats from such EMFs, starting with Wi-Fi.

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Board Member
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Board of Education

Re: Health effects of cell tower radiation

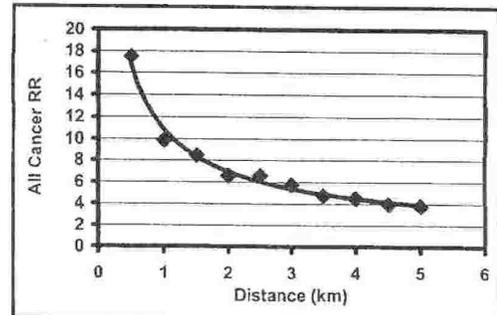
As an active researcher on biological effects of electromagnetic fields (EMF) for over twenty five years at Columbia University, as well as one of the organizers of the 2007 online Bioinitiative Report on the subject, I am writing in support of a limit on the construction of cell towers in the vicinity of schools.

There is now sufficient scientific data about the biological effects of EMF, and in particular about radiofrequency (RF) radiation, to argue for adoption of precautionary measures. We can state unequivocally that EMF can cause single and double strand DNA breakage at exposure levels that are considered safe under the FCC guidelines in the USA. As I shall illustrate below, there are also epidemiology studies that show an increased risk of cancers associated with exposure to RF. Since we know that an accumulation of changes or mutations in DNA is associated with cancer, there is good reason to believe that the elevated rates of cancers among persons living near RF towers are probably linked to DNA damage caused by EMF. Because of the nature of EMF exposure and the length of time it takes for most cancers to develop, one cannot expect ‘conclusive proof’ such as the link between helicobacter pylori and gastric ulcer. (That link was recently demonstrated by the Australian doctor who proved a link conclusively by swallowing the bacteria and getting the disease.) However, there is enough evidence of a plausible mechanism to link EMF exposure to increased risk of cancer, and therefore of a need to limit exposure, especially of children.

EMF have been shown to cause other potentially harmful biological effects, such as leakage of the blood brain barrier that can lead to damage of neurons in the brain, increased micronuclei (DNA fragments) in human blood lymphocytes, all at EMF exposures well below the limits in the current FCC guidelines. Probably the most convincing evidence of potential harm comes from living cells themselves when they start to manufacture stress proteins upon exposure to EMF. The stress response occurs with a number of potentially harmful environmental factors, such as elevated temperature, changes in pH, toxic metals, etc. This means that *when stress protein synthesis is stimulated by radiofrequency or power frequency EMF, the body is telling us in its own language that RF exposure is potentially harmful.*

There have been several attempts to measure the health risks associated with exposure to RF, and I can best summarize the findings with a graph from the study by Dr. Neil Cherry of all childhood cancers around the Sutro Tower in San Francisco between the years 1937 and 1988. Similar studies with similar results were done around broadcasting antennas in Sydney, Australia and Rome, Italy, and there are now studies of effects of cellphones on brain cancer. The Sutro tower contains antennas for broadcasting FM (54.7 kW), TV (616 kW) and UHF (18.3 MW) signals over a fairly wide area, and while the fields are not uniform, and also vary during the day, the fields were measured and average values estimated, so that one could associate the cancer risk with the degree of EMF exposure.

The data in the figure are the risk ratios (RR) for a total of 123 cases of childhood cancer from a population of 50,686 children, and include a 51 cases of leukaemia, 35 cases of brain cancer and 37 cases of lymphatic cancer. It is clear from the results that the risk ratio for all childhood cancers is elevated in the area studied, and while the risk falls off with radial distance from the antennas, as expected, it is still above a risk ratio of 5 even at a distance of 3km where the field was $1\mu\text{W}/\text{cm}^2$. This figure is what we can expect from prolonged RF exposure. In the Bioinitiative Report, we recommended $0.1\mu\text{W}/\text{cm}^2$ as a desirable precautionary level based on this and related studies, including recent studies of brain cancer and cellphone exposure.



As I mentioned above, many potentially harmful effects, such as the stress response and DNA strand breaks, occur at nonthermal levels (field strengths that do not cause a temperature increase) and are therefore considered safe. It is obvious that the safety standards must be revised downward to take into account the nonthermal as well as thermal biological responses that occur at much lower intensities. Since we cannot rely on the current standards, it is best to act according to the precautionary principle, the approach advocated by the European Union and the scientists involved in the Bioinitiative report. In light of the current evidence, the precautionary approach appears to be the most reasonable for those who must protect the health and welfare of the public and especially its most vulnerable members, children of school-age.

Sincerely yours,

Martin Blank, Ph.D.

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MCPS COO Dr. Andrew Zuckerman
MCPS Interim Superintendent Larry Bowers
MCPS Board of Education
MCPS Office of Technology
Montgomery County Schools
Carver Educational Services Center
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December 13, 2015

Dear Montgomery County COO Dr. Andrew Zuckerman, Interim Superintendent Larry Bowers, Board of Education and Office of Technology;

In my capacity as a pediatric occupational therapist, biologist, international speaker, and author on the subject of the impact of technology on child development and learning, I'm writing to you on behalf of students, teachers, and parents requesting you reconsider the use of devices which operate using wireless radiation.

Please find below guiding principles regarding managed balance between technology and healthy activity, as well as information on wireless radiation. More judicious use of educational based technologies in a safe manner, will serve to ensure sustainable futures for all children. Reversion to Ethernet or fiber optic cable devices, until such time as the World Health Organization deems wireless to not be harmful to young children, is recommended.

Guiding principles for the use of educational based technology in school environments.

Minimize Risk and Maximize Safety.

- Wireless radiation has not been proven safe (WHO 2011).
- Recent research indicates wireless radiation causes harmful effects to adult humans (Avendano 2012, Hardell 2013).
- Long term effects of wireless radiation on children are unknown at this time (AAP 2013).
- Children have thinner skulls, more aqueous bodies, and have rapidly developing cells, indicating they are exceedingly more vulnerable to harmful effects from wireless radiation than adults (AAP 2013, C4ST 2015).
- The American Academy of Pediatrics and the Canadian Pediatric Society recommends no more than 1-2 hours total technology use per day, including

educational technology. Many schools exceed these expert guidelines (AAP 2014).

Weigh Risk vs. Benefit.

- Education technology is not evidence based and is laden with conflict of interest e.g. manufacturers claims are financially motivated, and are not substantiated by university level research.
- Traditional and standardized teaching methods have substantive research support and evidence, yet are being rapidly replaced with education technology.

Ensure adequate foundational skills prior to use of technology.

Children need to balance the following 4 critical factors with technology, to optimize development and learning. Time spent with technology adversely affects these factors.

- *Movement*: stimulates vestibular, proprioceptive and cardiovascular systems.
- *Touch*: stimulates parasympathetic system for lowered cortisol and adrenalin.
- *Human Connection*: activates parasympathetic system; a life sustaining force.
- *Nature*: attention restorative, improves learning, erases effects of technology.
- *See video*: [Message to Schools on EdTech](#)

Risks associated with the use of technology by children are as follows:

- *Sedentary nature* of technology use is causally related to the recent rise in obesity/diabetes, developmental delay and learning difficulties (Tremblay 2011, HELP EDI Mapping 2009/13, Ratey 2008, PISA 2012).
- *Isolating factor* of technology use is associated with escalation in social impairments, mental illnesses (including adhd and autism), and self-regulation difficulties (Houtrow 2014).
- *Overstimulation* from technology use is a causal factor in rise in attention deficit, aggression, sleep disturbance, and chronic stress from hyper-arousal of the sympathetic nervous system (Christakis 2004, Gentile 2009, Markman 2010, Bristol University 2010).
- *Neglect* of students by teachers and support staff who are engaged in their own personal technology, is unfortunately common.
- Consequently, the risks associated with using education technology far outweigh the dubious benefits.

When In Doubt, Act With Caution.

- Existing research on harmful effects of wireless radiation on *adults*, indicates taking a cautionary approach when considering same radiation exposure to *children* (AAP 2014).

- Rapid cell turnover in children creates particular concern regarding potential DNA damage from wireless radiation, and consequent susceptibility to cancer. While rise in cancer incidence is becoming more apparent, rise in rates of cancer in children will not be observable until adulthood.
- Removal of wireless radiation and reversion to Ethernet cabled devices, will ensure immediate and long term safety to all students, teachers, and support staff.
- Defaulting to a remote authority regarding removing wireless radiation from schools, is not acting in the best interests of students and staff, and may not be defensible in a court of law.

Montgomery County's statement that the radiofrequency levels in schools "is compliant" with federal regulations *does not* assure safety to the students in your care. The current proposed technology plan to further increase the use of screens in classrooms on a daily basis, clearly does not support children's healthy development.

The implications of failure of schools to act with caution now regarding wireless radiation and technology, could potentially be horrific in both scope and magnitude, and may constitute neglect of children. Please act now to safeguard your children's future.

Respectfully,

CRowan

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January 20, 2016

Dear Montgomery County Board of Education,

Concerned parents in your school district have asked me to write to you regarding the health risks of wireless radiofrequency radiation exposure in the classroom. Based on what I have been told, I want to urge you to halt programs that currently have students use their own phones in ways that expose their eyes and brains to levels of radiation that have never been tested for safety.

I was Founding Director of the Board on Environmental Studies and Toxicology of the U.S. National Research Council, and Founding Director of the Center for Environmental Oncology at the University of Pittsburgh Cancer Institute. President Clinton appointed me to the Chemical Safety and Hazard Investigation Board, and I am former Senior Advisor to the Assistant Secretary for Health in the Department of Health and Human Services. I founded the non-profit Environmental Health Trust in 2007 to provide basic research and education about environmental health hazards. Our scientific team is currently focusing on the health risks of radiofrequency radiation as an important public health issue.

Many people are unaware that cell phones and wireless laptops and tablets function as two-way microwave radios. A typical classroom might have the following scenario: every student has a laptop--which is typically tested for use 8 inches from an adult male body--a cell phone in the pocket--which is also tested at a minimum distance from an adult male body-- and a network transmitter on the ceiling and possibly a cell tower outside next to the sports field. All these devices emit microwave radiation which can be readily absorbed into children's bodies and brains.

Manufacturers specifically recommend that cell phones be used “as tested”—at this little-known minimum distance from the body. Recently, *Consumer Reports* in November advised that people should not keep phones in the pocket—advice that few children or adults appreciate. *These devices have never been tested for safety with children.* Accumulating research indicates that long-term exposure to low levels over long lifetimes could pose a serious risk to our health.

Regarding tested distances for using laptops, the Federal Communications Commission (FCC) states that laptops and computers are “mobile devices are transmitters designed to be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.” The body in this instance refers to a large male weighing more than 200 pounds and standing six feet tall.

As the county is preparing to increase student use of Chromebooks, please be aware that the Samsung [Chromebook manual](#) states:

“United States of America USA and Canada Safety Requirements and Notices

- Do not touch or move antenna while the unit is transmitting or receiving.
- Do not hold any component containing the radio such that the antenna is very close or touching any exposed parts of the body, especially the face or eyes, while transmitting.
- Regardless of the power levels, care should be taken to minimize human contact during normal operation.
- This device should be used more than 20 cm (8 inches) from the body when wireless devices are on and transmitting.
- FCC Statement for Wireless LAN use: *“While installing and operating this transmitter and antenna combination the radio frequency exposure limit of 1mW/cm² may be exceeded at distances close to the antenna installed. Therefore, the user must maintain a minimum distance of 20cm from the antenna at all times.”*

As one of the leaders in educational policy of this nation, your school district has an opportunity to set an example for school districts nationwide by installing safer technology in classrooms and educating students, teachers and staff about tested distances that devices should be used to reduce radiation. A number of public and private schools have already implemented such policies. Just as we provide children with seat belts and bike helmets, a precautionary approach to wireless is recommended by many scientists and governments worldwide.

For more information about all of these issues, please read cell phone instructions for various models at <http://showthefineprint.org>. Our [newly posted Ebook](#) also details fine print safety instructions in wireless device user manuals.

When children use these devices close to their bodies, they are exceeding these safety instructions, and exposing themselves to radiofrequency (RF) radiation levels which can exceed our government FCC RF radiation exposure limits. The FCC RF exposure limit was designed to protect the public from the thermal (heating) effects of acute exposure to RF energy. The FCC states, “Tissue damage in humans could occur during exposure to high RF levels because of the body's inability to cope with or dissipate the excessive heat that could be generated. Two areas of the body, the eyes and the testes, are particularly vulnerable to RF heating because of the relative lack of available blood flow to dissipate the excess heat load.”

CHILDREN ABSORB MORE RADIATION THAN ADULTS

Our recently published research in the [IEEE Spectrum](#) with investigators at the Federal Universities of Brazil provides new state-of-the-art radiation exposure brain modeling which confirms that substantially higher radiofrequency radiation doses occur in younger children as compared to adults even where products comply with tested guidelines developed for adults.

FCC REGULATIONS ARE OUTDATED

FCC exposure limits were set more than 19 years ago and were based on decades-old research. The Government Accountability Office published a [2012 Report](#) that calls on the FCC to formally reassess their current RF energy (microwave) exposure limits, stating that the “FCC RF energy exposure limit *may not* reflect the latest research.” I encourage you to read scientific submissions to FCC Proceeding Number 13-84 at <http://bit.ly/1aGxQiq>. It is unknown when the FCC will make a ruling, however, *until that time* the current outdated FCC limits are *not reflective* of the current state of science.

FCC REGULATIONS DO NOT PROTECT THE PUBLIC FROM BIOLOGICAL EFFECTS

As the California Medical Association states in their [2014 Resolution](#) calling for updated FCC Regulations, “peer reviewed research has demonstrated adverse biological effects of wireless EMF [electromagnetic fields] including single and double stranded DNA breaks, creation of reactive oxygen species, immune dysfunction, cognitive processing effects, stress protein synthesis in the brain, altered brain development, sleep and memory disturbances, ADHD, abnormal behavior, sperm dysfunction, and brain tumors.”

In May 2015, over 200 scientists who have authored more than 2,000 articles on this topic appealed to the United Nations to address “the emerging public health crisis” related to cellphones and other wireless devices, urging that the United Nations Environmental Programme (UNEP) initiate an assessment of alternatives to current exposure standards and practices that could substantially lower human exposures to non-ionizing radiation. These scientists state that “the ICNIRP guidelines do not cover long-term exposure and low-intensity effects, “ and are “ insufficient to protect public health.” They also state that “the various agencies setting safety standards have failed to impose sufficient guidelines to protect the general public, particularly children who are more vulnerable to the effects of EMF.” Please see their website at <https://emfscientist.org>.

INCREASED CANCER RISK

Wireless radiofrequency radiation was classified as a Class 2B “Possible Human Carcinogen” by the World Health Organization’s International Agency for Research on Cancer in 2011. According to many scientists, evidence *has increased* since 2011, indicating that cell phone and wireless radiation should be classified as a “probable carcinogen.” Those exposed at younger ages show four to eight times increased cancer risk. [Replicated research](#) just published in Biochemical and Biophysical Research Communications indicates that radiofrequency acts as a *tumor promoter* at low to moderate levels.

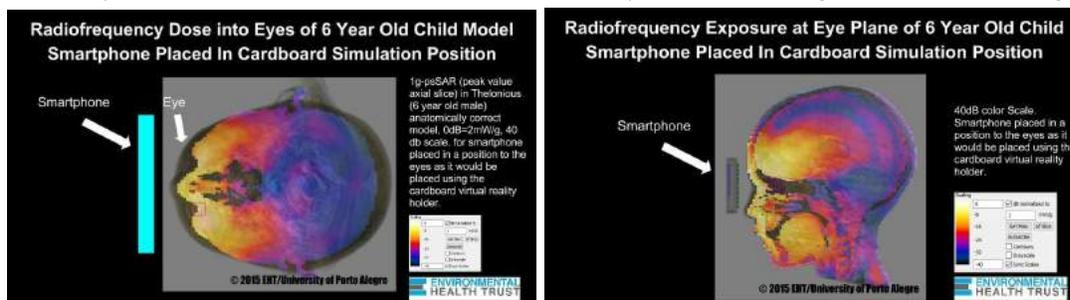
CONCERN FOR PREGNANT STUDENTS AND STAFF

Pregnant students and staff are especially at risk from wireless because the fetus is the most vulnerable to toxic exposures. Several experimental studies are showing irreversible changes after prenatal exposure to cell phone and wireless radiation such as altered brain functioning, decreased brain cells and altered reproductive organ development. More than 100 physicians, scientists and public health professionals joined together to express their concern about the risk that wireless radiation poses to pregnancy and now *urge pregnant women to limit their exposures*. Please read these scientists [BabySafe Joint Statement](#)

VIRTUAL TECHNOLOGY RESULTS IN HIGHER EXPOSURES TO THE EYE AND BRAIN

Most recently, I was contacted by a parent in your district about the virtual reality devices now used in MCPS classrooms to go on a virtual “field trip.” As indicated by online instructions, this experience involves using smartphones placed directly in front of the child’s eyes so that they can directly watch a fascinating video of faraway lands. The smartphone is streaming radiation throughout the classroom from the teacher's iPad for the entire “field trip.”

Please be aware that FCC regulations set decades ago did not utilize science that looks at the effects from cell phones on different body tissues such as the eyes. Upon hearing about this issue, I contacted EHT-associated scientists at federal universities of Brazil who do state-of-the-art computer modeling. I asked them to position the phone as it would be in the virtual reality cardboard for use in front of the child’s eyes and assess the microwave radiation. The yellow and orange color show the highest exposures.



My colleagues and I are sharing this work with you today because we believe you should have more information about microwave radiation exposures that will take place through this system.

This research image above utilizes [a sophisticated computer system](#) that the U.S. Food and Drug Administration (FDA) currently applies to evaluate medical devices. It simulates the radiation absorption into *anatomically correct models*--something that currently used systems for testing phones and devices cannot do. [In a study from Memorial Sloan-Kettering Cancer Center](#), radiation physicist David Gultekin, working with Bell Labs electrical engineer Lothar Moeller, reported that normal working cell phones can create tiny hotspots within brain tissue. Unlike other organs, [eyes](#) do not have circulation to effectively carry away heat.

In addition to the impact from the microwave radiation, there could also be impacts to a child’s retina from the blue light emitted by the screen. Youths under the age of 20, and especially very young children,

have little or no yellowing of the lens (which helps protect the adult eye). Therefore, blue light (or UV) which enters the eye is unfiltered in children and strikes the retina at full-strength exposing not only the retina, but the lens to possible damage over the long time. Such injury may not be evident until later in time.

In 2010, [Andreas Christ and team](#) reported that children's hippocampus and hypothalamus absorbs 1.6–3.1 times higher and the cerebellum absorbs 2.5 times higher microwave radiation compared to adults; children's bone marrow of the skull absorbs 10 times higher microwave radiation than in adults, *and children's eyes absorb much higher microwave radiation than adults*. A recent [Deans' Lecture I](#) delivered to University of Melbourne provides an overview on this research.

SIMPLE STEPS WILL PROTECT CHILDREN

Compelling research raises the possibility of very serious harm to children from radiofrequency radiation exposures well below “FCC compliant” levels. Legal does not mean safe. Based on the preliminary work that I share with you here, I urge you to forgo the use of such devices such as virtual reality cardboard as there is no research that has considered their impact on children’s eyes. At this time, the smart choice for school decision makers is to act now and reduce radiofrequency wireless exposures. In fact, many countries (over 20) and health authorities worldwide recommend reducing radiofrequency radiation to children.

More recently, the Cyprus Government's National Committee on Environment and Children's Health released a [video about reducing wireless](#) and I invite you to watch this excellent example of responsible action at this link <https://www.youtube.com/watch?v=H43IKNjTvRM> .

I understand that your county has a Bring Your Own Device policy whereby cell phones are not only allowed *in* the classroom but are actively used in the curriculum. As I have been told, students in film class might use their cell phones to take footage to create a movie, and in some math classes they use their cell phones as a calculator. Advice should be routinely provided to any student using a wireless device at school about *how to reduce exposures*. For example, if phones are used on airplane mode, and wireless is turned off on computers then these devices will neither send nor receive microwave radiation.

When powered on, phones undergo short bursts of microwave radiation up to 900 times per minute, *whether or not the phone is being used for talking*. Once teachers and students are educated on how they can simply turn their phone onto airplane mode, then they can use the phone in the classroom *without* being exposed to unnecessary radiofrequency radiation.

Likewise, laptops such as Chromebooks are also emitting constant radiation and at much higher levels when a student is streaming video or using cloud based applications. Laptops can easily be hardwired to ethernet so that students can safely use the internet without radiation emissions. Please review the [Best Practices for Low EMF in Schools developed by the Northeast Collaborative For High Performing Schools](#) which details how schools can reduce exposure to radiofrequency fields and still have full internet connectivity.

Along with [the recommendation](#) of over 200 scientists (see <https://emfscientist.org>) and health authorities worldwide, I recommend that the best course of action is to take simple precautions—as many nations already currently advise. *Children’s exposures to wireless radiation should be reduced as much as possible.* We have a responsibility to act now to reduce children’s exposure to radiofrequency radiation. Children’s nervous, immune and reproductive systems are rapidly developing and, along with pregnant women, children deserve an abundance of caution.

As several colleagues and I wrote in [a letter](#) to the U.S. Secretary of Education just a few months ago, we recommend your school district do the following:

1. **Raise school community awareness through new educational curriculum:** Students, teachers and their families should be given information on wireless health risks and simple precautionary steps they can take to protect their health. It is important to teach children how to use technology both safely and more responsibly in order to protect their health and wellbeing.
2. **Install a safe communication and information technology infrastructure in schools to meet educational needs:** Solutions exist to reduce exposures to wireless emissions and mitigate the health risk. Low-EMF Best Practices have been developed, allowing educational needs to be met with safer, hard-wired Internet connections, which are also faster and more secure.

Low-EMF Best Practices are the solution that allows for full communication, information access and learning tools use in the classroom while minimizing unnecessary health risks. Your district can thoughtfully integrate safe technology into every classroom while responsibly safeguarding the health of every generation.

I fully understand that this information has not been widely understood. I would be happy to provide or develop an online technical briefing to your senior staff to assist you as you make decisions today that will affect the health of students for the rest of their lives.

Yours respectfully,



Devra Davis, PhD MPH
President and Founder
Environmental Health Trust
Visiting Professor of Medicine
The Hebrew University, Hadassah Medical Center
Associate Editor, *Frontiers in Radiation and Health*
ehtrust.org



July 28, 2014

Board of Trustees
Fay School
48 Main Street
Southborough, MA 01772

Re: Advisability of WiFi in schools

Dear Sirs/Madams:

This is concerning potential adverse health effects associated with exposure to radiofrequency/microwave (RF/MW) radiation, specifically that from wireless routers and wireless computers. I am writing to express concern that students at your school are experiencing electrosensitivity symptoms from these technologies.

I am a public health physician who has been involved in issues related to electromagnetic fields (EMFs) for several decades. I served as the Executive Secretary for the New York Powerline Project in the 1980s, a program of research that showed that children living in homes with elevated magnetic fields coming from powerlines suffered from an elevated risk of developing leukemia. I served as Director of the Wadsworth Laboratory of the New York State Department of Health, as well as Dean of the School of Public Health at the University at Albany/SUNY. I have edited two books on effects of EMFs, ranging from low frequency fields to radiofrequency/ microwave radiation, or the kind emitted by WiFi routers, cell phones, neighborhood antennas and wireless computer equipment. I served as the co-editor of the BioInitiative Report 2012 (Bioinitiative.org), a comprehensive review of the literature showing biological effects at non-thermal levels of exposure, much of which has since been published in the peer-reviewed journal, *Pathophysiology* (attached). Also, I served on the President's Cancer Panel that examined radiation exposures as they relate to cancer risk, in 2009, and a report from that testimony is also attached. Thus, this is a subject which I know well, and one on which I take a public health approach rooted in the fundamental principle of the need to protect against risk of disease, even when one may not have all the information that would be desirable.

There is clear and strong evidence that intensive use of cell phones increases the risk of brain cancer, tumors of the auditory nerve and cancer of the parotid gland, the salivary gland in the cheek by the ear. The evidence for this conclusion is detailed in the attached publications. The WHO's International Agency for Research on Cancer has also classified the radiation from both cell phones and WiFi as a Class 2B "Possible Carcinogen" (2011). WiFi uses similar radio-frequency radiation as cell phones (in the 1.8 to 5.0 GHz range). The difference between a cell phone and a WiFi environment, however, is that while the cell phone is used only intermittently, and at higher power, a WiFi environment is continuous, and transmitting even when not being used. In addition, WiFi transmitters are indoors, where people (and in this case, children) may be very close by, or certainly close to devices using the WiFi, such as wireless computers, iPads and smart boards, the radiation from which can be intolerable to sensitive people.

Furthermore, commercial routers, like those in schools, operate at much higher wattage than consumer routers. They are designed to penetrate through materials like cement, wood and brick, to handle dozens to hundreds of users, and to reach into outdoor areas, so industrial grade routers are of much greater concern.

An additional consideration to appreciate is that it is not only the power of wireless radiation that causes biological dysregulation, but the frequencies, pulsing, amplitude, and the quantity and kind of information being transmitted that can have effects as well. These 'non-thermal effects' have been shown in thousands of studies to be biologically active, and may be more important than the effects from the power. Thus, while a router may be in the ceiling, or not right next to a student, teacher or administrator, the known biological and health effects, particularly the non-thermal ones, are still very much occurring.

Finally, while acute electrosensitivity symptoms, like the ones I understand your students are experiencing, are of course of great concern (such as cognitive effects impairing attention, memory, energy levels, and concentration; cardiac irregularities, including in children; or, headaches or other symptoms in students wearing braces), the full effects for society from chronic and cumulative exposures are not known at this time. Given what we do know, however, including the DNA effects, I must, as a public health physician, advise minimizing these exposures as much as possible. Indications are that cell phones and wireless technologies may turn out to be a serious public health issue, comparable to tobacco, asbestos, DDT, PCBs, pesticides and lead paint, or possibly worse given the ubiquitous nature of the exposures. While unfortunately we must wait for federal regulation to catch up with the science, the prudent thing to do in the interim would be to exercise precaution at every opportunity.

Computers and the world-wide web have tremendous value in education, but the value also depends on how these are used in numerous respects. As wired internet connections do not pose radiation risk, are readily available, are faster and more secure than WiFi, and are now even available for certain tablets, I highly recommend you factor the risks I have described into your technology planning. At the same time, I would urge you to take the complaints of your students very seriously, and potentially involve the school nurse and teachers in helping to assess the extent of the electrosensitivity problem among students at the school.

An excellent reference on the EMF and electrosensitivity science is "Electrosensitivity and Electrohypersensitivity—A Summary" (2013) authored by M.J. Bevington and available through Electrosensitivity-U.K. (www.es-uk.info/)

If I can be of further help, please do not hesitate to call.

Yours sincerely,



David O. Carpenter, M.D.
Director, Institute for Health and the Environment
University at Albany

Enclosures

Martin Blank, PhD
Department of Physiology and Cellular Biophysics
Columbia University
New York, NY 10032

July 25, 2014

Mr. Thomas McKean, President, Board of Trustees
Mr. James Shay, President-Elect, Board of Trustees
Fay School
48 Main Street
Southborough, MA01772

To the Board of Trustees,

It has been brought to my attention that school children have become symptomatic at your school after installation of WiFi. I am writing to express my concern and to encourage you to review the independent science on this matter.

I can say with conviction, in light of the science, and in particular in light of the cellular and DNA science, which has been my focus at Columbia University for several decades, putting radiating antennas in schools (and in close proximity to developing children) is an uninformed choice. Assurances that the antennas are within 'FCC guidelines' is meaningless today, given that it is now widely understood that the methodology used to assess exposure levels only accounts for one type of risk from antennas, the thermal effect from the power, not the other known risks, such as non-thermal frequencies, pulsing, signal characteristics, etc. They fail also to consider multiple simultaneous exposures from a variety of sources in the environment, and cumulative exposures over a lifetime. Compliance with FCC guidelines, thus, unfortunately, is not in any way an assurance of safety today, as the guidelines are fundamentally flawed. Until the guidelines and advisories in the U.S. are updated, the intelligent thing for your Board of Trustees to do is to exercise the Precautionary Principle and hard wire all internet connections.

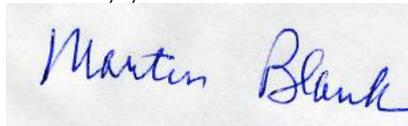
I know this might be disappointing to hear, as I understand you have invested in the WiFi. But there is no amount of money that could justify the added physiological stress from wireless antenna radiation and its many consequences, most in particular for children. Our research has shown that the cellular stress response, a protective reaction that is indicative of cellular damage, occurs at levels that are deemed 'safe'. Many other harmful reactions have been reported, such as the impairment of DNA processes that can account for the observed increased risk of cancer, as well as the potential cognitive decline, and sleep effects that may be due to impairment of the blood brain barrier. The DNA effects are of particular concern for future generations, an area of research that is just beginning to raise alarms. As with other environmental toxic exposures, children are far more vulnerable than adults, and they will have longer lifetimes of exposure.

The science showing reasons for concern about the microwave radiation emitted by antennas is abundant and there will be a day of reckoning. As I explain in my recent book,

Overpowered, The Precautionary Principle instructs us that in the face of serious threats, a lack of scientific 'certainty' never justifies inaction. The changes occurring at the molecular level, and known associations with many diseases, are sufficient at this time to give us pause and to recommend minimizing exposures to these fields, in our homes, schools, neighborhoods and workplaces. There is significant potential for risk, and to very large numbers of people, and the effects are occurring nonetheless whether or not we are noticing them.

I recommend you hardwire the internet connections at your school, and also encourage students to use hard wired connections at home for internet access, as well as for all computer equipment connections and voice communications.

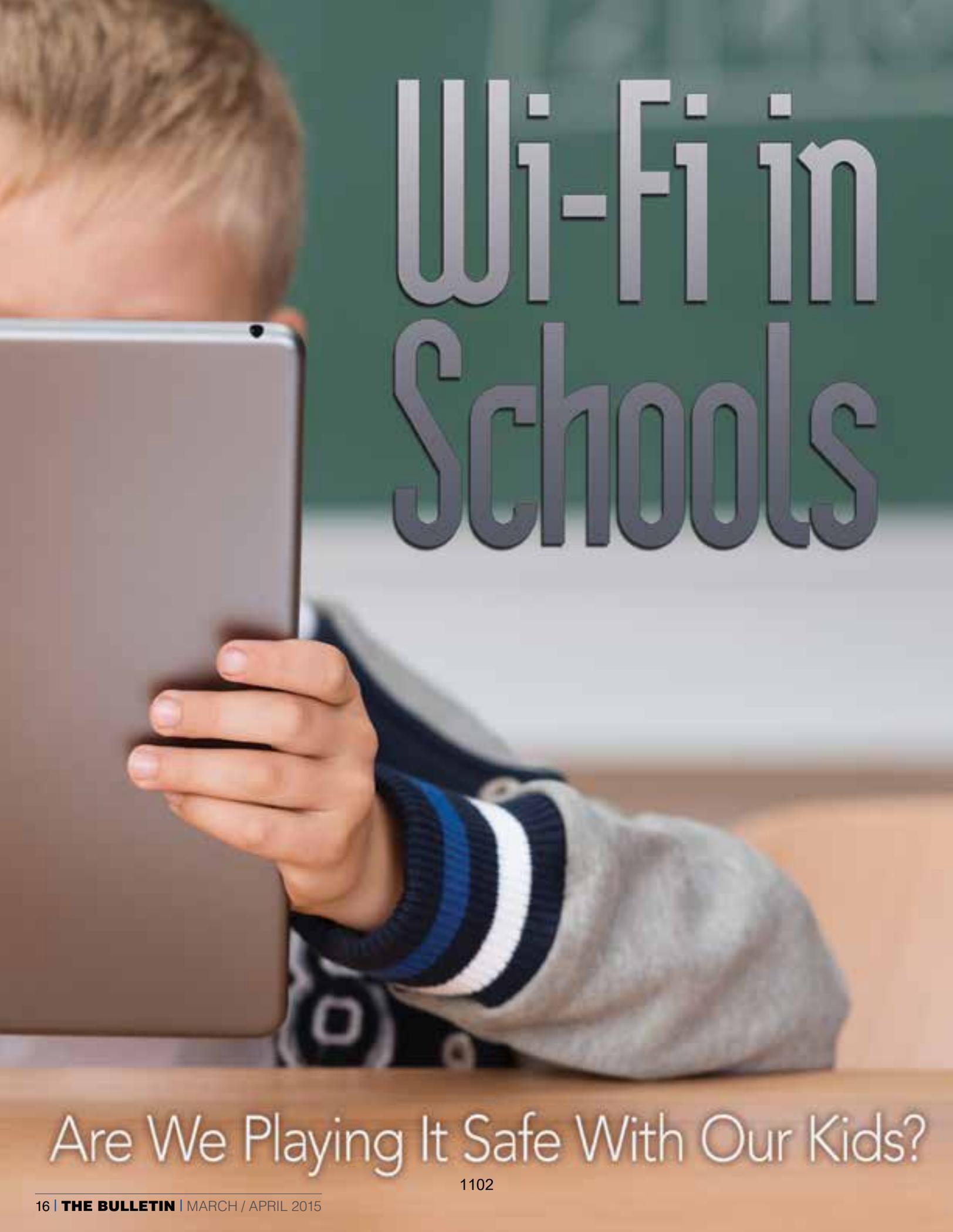
Sincerely yours,



Martin Blank, PhD
mb32@columbia.edu,



Martin Blank, PhD, Special Lecturer and (ret.) Associate Professor, Columbia University, Department of Physiology and Cellular Biophysics. Dr. Blank is a leading expert in the effects of electromagnetic fields on DNA and biology, and Past President of the Bioelectromagnetics Society. He holds two PhDs, in physical chemistry and in colloid science, an interdisciplinary field involving chemistry, physics and nanoscience. Dr. Blank was author of the BioInitiative Report's section on the impact of electromagnetic fields on Stress Proteins; Editor of the journal *Pathophysiology's* special issue on Electromagnetic Fields (2009); and co-author of "Electromagnetic fields and health: DNA based dosimetry" (2012), which recommends a new way of assessing the biological impact of electromagnetic fields across the spectrum, using DNA. Dr. Blank's book, "*Overpowered—What Science Tells Us About the Dangers of Cell Phones and Other WiFi-Age Devices*", was published in 2014.



Wi-Fi in Schools

Are We Playing It Safe With Our Kids?

“Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children. It is essential that any new standard for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded throughout their lifetimes.” American Academy of Pediatrics Letter to FCC August 29, 2013 (20)

By Cindy Russell, MD

VP of Community Health, SCCMA

Industry has been quite successful in creating magically useful wireless technologies such as cell phones, Ipads, Wi-Fi, and now wearable tech devices such as Google glasses, we all love. Many of these handy gadgets have now reached the typical classroom across the globe. It has become apparent, however, that there are substantial downsides to being too connected to technology and as safety concerns mount, governments such as France and Israel are backing away from the blind adoption of wireless technology in schools, especially for young children.

These devices are cool and convenient, however there remains nagging questions of overuse and safety as the application of these devices has increased to the point we are literally exposed 24 hours a day to this radiation. Wireless microwaves come from many sources both at work and at home.

An increasing number of physicians, scientists, and parents are concerned about long term health effects from Wi-Fi in schools. (42)(43)(44)(49) As any parent knows, computers now are as ubiquitous in schools as they are at work. From kindergarteners on up kids are required to learn computer skills in order to take core testing online. There is a push to enable students to be connected to the internet 24/7 to take photos, email documents, and research a topic. In schools, wired connections for computers have been rapidly being eliminated to install wireless systems that connect students both indoors and outdoors on campus.

Europe and some schools in the U.S. are taking a different more precautionary approach and going back to the future with wired plug in computers. Studies have also cast doubt on some of the benefits of classroom computers and warned of the new age of “Digital Dementia” which has now crept into Korean youth due to the heavy use of electronic gadgets. (17)(48)

Professors in college are banning computers during lectures and finding students learn more. (38) (39)

CHILDREN ARE MORE VULNERABLE THUS NEED MORE PROTECTION

Children have several organ systems that are immature at birth and are thus much more sensitive to toxic exposures. The human brain, one of the top vital organs, is far from being a finished product in youth. Long-term structural maturation of the nervous system is required for successful development of cognitive, motor, and sensory functions. Neuronal axons – long thin projections from the nerve cell – act as electronic transmission lines. Axons in major pathways of the brain continue to develop throughout childhood and adolescence. Myelin is the insulation surrounding individual nerves protecting it from outside electrical charges. The process of myelination is much faster the first two years but continues into adulthood. (16) Children have thinner skulls (29), their immune systems are undeveloped, their cells are dividing more rapidly, thus, they are more vulnerable to EMF radiation and other carcinogens. They also have a longer cumulative exposure to all toxins including EMF radiation.

CURRENT WIRELESS SAFETY STANDARDS AND MICROWAVING POTATOES

Wireless devices work on high frequency microwaves similar to the microwave you use to cook food with. It is with less power but substantial research (1)(2)(3)(4) demonstrates that even at low power within the current safety standards these microwaves can cause biologic harm to plants, animals, and cellular structures. Current Federal Communications Commission (FCC) standards are based only on heat generated by the device, not on adverse biological effects seen in hundreds of studies and at much lower levels.

Our own CMA supports reassessment of EMF standards. The California Medical Association, in 2014, passed a resolution as follows:

“Resolved 1: That CMA supports efforts to re-evaluate microwave safety exposure levels associated with wireless communication devices, including consideration

of adverse nonthermal biologic and health effects from non-ionizing electromagnetic radiation used in wireless communications and be it further

Resolved 2: That CMA support efforts to implement new safety limits for wireless devices to levels that do not cause human or environmental harm based on scientific research.

ADVERSE EFFECTS DEMONSTRATED IN PEER REVIEWED PUBLISHED RESEARCH (2)

- DNA with single and double stranded breaks
- Leakage of the blood brain barrier (two hours of cell phone exposure causes 7+ days of albumin leakage)
- Stress protein production in the body indicating injury
- Infertility/reproductive harm
- Neurologic harm with direct damage to brain cells
- Lowering of melatonin levels
- Immune dysfunction
- Inflammation/oxidation.

PLAUSIBLE MECHANISM FOUND FOR EMF MICROWAVE EFFECTS

Dr. Martin Pall, Professor Emeritus of Biochemistry, Washington State University has studied how electromagnetic fields impact the cells of our bodies. His 2013 paper on this subject highlights a major biological mechanism of action of EMF microwave radiation on cell structure. His work, along with two dozen prior studies, demonstrated that EMF microwave radiation effects cellular calcium channels and this can be inhibited with calcium channel blockers. "A whole series of biological changes reportedly produced by microwave exposures can now be explained in terms of this new paradigm of EMF actions via Voltage Gated Calcium Channels (VGCC) activation." (14)(15)

EMF AFFECTS ON WILDLIFE: BIRDS, BEES, AND TOMATO PLANTS

Bird researchers in Germany found that their migratory European Robins lost their sense of navigation when in the city. (5) This was found to be due to the EMF radiation interfering with the bird's special internal magnetic compass. They replicated the experiment over seven years before publishing the results in the prestigious journal *Nature*.

John Phillips and others have found that newts, sea turtles, and migratory birds use a magnetic compass to navigate long distances and this can be interrupted by low levels of EMF. (6)(7) A review of effects on cell towers and wireless devices showed that beehives can have rapid colony collapse with exposure to cell phone radiation. (8)

Plants have been shown to have stress response to EMF from wireless devices. (9)(10) (22) In tomatoes exposed for short duration, the stress response seen by exposure to EMF was prevented by administration of calcium counteracting drugs. (11) Even simple high school science experiments document abnormal seed growth near Wi-Fi routers. (19) There appear to be adverse biological effects of this seemingly harmless radiation.

HUMAN ELECTROSENSITIVITY: IS IT REAL?

There is varied opinion about those who state they are sensitive to EMF. Scientific research has not given a definitive answer, nevertheless, many seem to suffer from vague and often disabling symptoms they feel in the presence of EMF. Exposure to EMF radiation in some people reportedly causes headaches, memory problems, fatigue, sleep disorders, depression. This is so significant for some people that they have to live in a very low EMF environment to feel normal. (25)

Sweden recognizes electro-sensitivity as a functional impairment and estimates that about 3% of the population suffers from this. (23)(24) Dr. Magda Havas found in replicated studies that some EMF sensitive individuals heart rates increased with wireless devices turned on in double blind study. (12)(26) Researchers at Louisiana State University, in 2011, studied a self reported EMF sensitive physician and found "In a double-blinded EMF provocation procedure specifically designed to minimize unintentional sensory cues, the subject developed temporal pain, headache, muscle twitching, and skipped heartbeats within 100 s after initiation of EMF exposure ($p < .05$)." They concluded that "EMF hypersensitivity can occur as a bona fide environmentally inducible neurological syndrome." (27)

Genius and Lipp reviewed the current literature on EHS, in 2011, and point to several explanations for this multisystem phenomenon, including toxicant induced loss of tolerance as many with EHS symptoms had high levels of PCB's possibly causing immune dysfunction. Scientific research also identifies an inflammatory response with cytokine production. Another aspect of research points to catecholamine and adrenal gland dysfunction. In addition, heavy metal toxicity has also been proposed as contributing to EHS. (28)

The Austrian Medical Association feels Electrohypersensitivity is a real phenomenon and in 2012 published Guidelines for EMF and Electro-hypersensitivity. They state the primary method of treatment should consist in the prevention or reduction of EMF exposure, taking care to reduce or eliminate all sources of EMF if possible. (32)

In May 2011, the International Agency for Research on Cancer (IARC) classified radiofrequency electromagnetic fields as possibly carcinogenic to humans (Group 2B).(30)

GOVERNMENT ACTIONS ON WI-FI IN SCHOOLS

While much of the U.S. is marching forward with Wi-Fi in schools, Europe is changing direction, as indicated by the policies listed below. (45) Internationally there is wide disagreement in standards. The U.S. and Canadian limits are 1000 microwatts/cm². China and Russia are 10 microwatts/cm². Belgium is 2.4 microwatts/cm², and Austria is 0.001 microwatts/cm². The Bioinitiative Report 2012 recommendation for "No Observable Effect" is 0.0003 microwatts/cm². Cosmic background EMF we evolved with is <0.0000000001 microwatts/cm². (2)

COUNCIL OF EUROPE PARLIAMENT ASSEMBLY 2011 EMF MICROWAVE POLICY : "THE POTENTIAL DANGERS OF ELECTROMAGNETIC FIELDS AND THEIR EFFECT ON THE ENVIRONMENT"

The report notes "other non-ionizing frequencies, whether from ex-

tremely low frequencies, power lines or certain high frequency waves used in the fields of radar, telecommunications, and mobile telephony, appear to have more or less potentially harmful, non-thermal, biological effects on plants, insects, and animals, as well as the human body, even when exposed to levels that are below the official threshold values.”

The Council calls for a number of measures to protect humans and the environment, especially from high-frequency electromagnetic fields. One of the recommendations is to “take all reasonable measures to reduce exposure to electromagnetic fields, especially to radio frequencies from mobile phones, and particularly the exposure to children and young people who seem to be most at risk from head tumors”. (37)

IN FRANCE: A NEW NATIONAL LAW BANS WI-FI IN NURSERY SCHOOLS

In January 2015, France passed a landmark law that calls for precaution with wireless devices for children and the general public. (34)(35) It calls for:

1. Wi-Fi banned in nursery schools.
2. Wi-Fi routers should be turned off in school when not in use.
3. Schools are informed when new tech equipment is installed.
4. Citizens will have access to environmental cell tower radiation measurements near homes.
5. There will be continued research conducted into health effects of wireless communications.
6. Information on reducing exposure to EMF radiation is mandatory in the contents of the cell phone package.
7. Wi-Fi hotspots are labeled.

ISRAELI MINISTRY OF EDUCATION ISSUE GUIDELINES TO LIMIT WI-FI IN SCHOOLS

On August 27, 2013, the Israeli Ministry of Education issued new guidelines regarding Wi-Fi use in schools.

(33) The guidelines will:

1. Stop the installation of wireless networks in classrooms in kindergarten.
2. Limit the use of Wi-Fi between first and third grades. In the first grade, students will be limited to use Wi-Fi to study for one hour per day and no more than three days per week. Between the first and third grades, students will be limited to use Wi-Fi up to two hours per day for no more than four days per week.
3. To limit unnecessary exposure teachers will be required to turn off mobile phones and Wi-Fi routers when they are not in use for educational purposes.
4. All Wi-Fi equipment be tested for compliance with safety limits before and after installation in an Israeli school.
5. Desktop computers and power supplies be kept at least 20 cm from students.

2012 THE RUSSIAN COMMITTEE ON NON-IONIZING RADIATION PROTECTION



OFFICIALLY RECOMMENDED THAT WI-FI NOT BE USED IN SCHOOLS.

2011 THE RUSSIAN COMMITTEE ON NON-IONIZING RADIATION PROTECTION (RNCNIRP) RELEASED THEIR RESOLUTION ENTITLED “ELECTROMAGNETIC FIELDS FROM MOBILE PHONES: HEALTH EFFECTS ON CHILDREN AND TEENAGERS.”

According to the opinion of the Russian National Committee on Non-Ionizing Radiation Protection, the following health hazards are likely to be faced by the children mobile phone users in the nearest future: disruption of memory, decline of attention, diminishing learning and cognitive abilities, increased irritability, sleep problems, increase in sensitivity to the stress, increased epileptic readiness. (36)

Expected (possible) remote health risks: brain tumors, tumors of acoustical and vestibular nerves (in the age of 25-30 years), Alzheimer’s

Continued on page 20

disease, “got dementia”, depressive syndrome, and the other types of degeneration of the nervous structures of the brain (in the age of 50 to 60).

PLAYING IT SAFE FOR OUR KIDS

A healthy and safe learning environment is a cornerstone of education. Current FCC standards are obsolete and inappropriate as they are based only on heat effects, not biological effects. They give us a false sense of security. There may be higher EMF levels at school than at home as routers are more powerful. Cumulative Effects on DNA or cell structures are not taken into consideration in any safety standard. Because of the long-term exposure to EMF microwave radiation this generation is experiencing, they will be at higher risk for potential health problems. We will not know what happens to our progeny’s DNA until our grandchildren are born.

Considering there has been a more precautionary approach internationally to microwave radiation exposure and the trend is toward less exposure in schools, especially to vulnerable populations such as children, it makes sense to re-evaluate our wireless schools. We buckle our seat belts and wear a helmet when we ride bikes even though we don’t know if we will get in an accident. Although not all the issues of wireless microwaves are understood, there is enough science to understand it acts as a toxicant at even low levels that fall within current safety standards. We also know

3. **Limit Wi-Fi use**, especially in younger grades.
4. **Cell phones stay off and in the backpacks during class** and on the campus during school hours.
5. **Have EMF and electrical measurements done by one or more qualified, experienced consultants before and after any installation.** Understand you may need to increase your knowledge of low and high frequency electromagnetic fields and limits to accurately interpret the reports. The Bioinitiative Report is a very useful compendium that has recommendations for safer levels.
6. **Support efforts by governments to provide independent standardized transparent research to define safe limits in all the different wireless frequencies used commercially.** This could lead to less EMF emissions and safer wireless devices.

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“Certain high frequency waves used in the fields of radar, telecommunications, and mobile telephony, appear to have more or less potentially harmful, non-thermal, biological effects on plants, insects, and animals, as well as the human body, even when exposed to levels that are below the official threshold values.”

that decades of research precedes meaningful regulation in the area of toxins, thus the only reasonable approach is precautionary.

In addition, we need to be thoughtful about how much our kids should use computers and what this is doing not only to them, but to our society as a whole. We get starry eyed with every new wireless gadget, however, in “Alone Together” Sherry Turkle expertly addresses the rise in isolation, loneliness, lack of privacy, and increasing pressure on students in this age of invasive technology. Her thorough and non-judgmental scientific investigation of the psychological effects of computers makes us aware that we need to take care that we do not replace real human connection with a “virtual reality” that will redirect us in an unhealthy direction.

As physicians and parents, we understand that decisions we make today may have far reaching consequences in the future for our kids. Let’s play it safe for them right now.

RECOMMENDATIONS FOR SCHOOLS

1. **Wired internet connections** like we used to have are the safest and possibly cheapest option – all the benefits of the internet without the risk.
2. **Wireless devices**, but with an on/off switch in each room so teachers can use only when needed for educational purposes.

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STEPHEN T. SINATRA M.D., F.A.C.C.

F.A.C.N., C.N.S., C.B.T.,
Integrative Metabolic Cardiology

July 16, 2014

Chairman and Trustees
Fay School
48 Main Street
Southborough, MA 01772

RE: Wi-Fi in Schools

Dear Chairman and Trustees:

I am writing this letter on behalf of concerned parents of children who are attending schools with Wi-Fi technology. I'm a cardiologist and co-founder of Doctors for Safer Schools, an organization dedicated to informing teachers, parents and superintendents about the uncertainty and possible environmental health hazards of Wi-Fi technologies.

The heart is a delicate and complex electromagnetic organ that can be adversely affected by exogenous signals from wireless technology and microwave radiation. For this reason it is unwise to expose students and teachers to Wi-Fi radiation for internet access, especially when safer alternative wired options are available. Children are particularly vulnerable to this radiation and the incidents of cardiovascular events including sudden cardiac arrest, seems to be increasing, especially among young athletes (up to the age of 19). In some cases this is due to undetected heart defects, blunt trauma to the heart in contact sports, and heat stress during strenuous exercise, but in instances these irregularities may be exacerbated by or due to microwave signals interfering with the autonomic nervous system that regulates the heart.

I know this because I am a board certified cardiologist and have been a Fellow of the American College of Cardiology since 1977. At the Manchester Memorial Hospital in Connecticut, I served in several roles, including Chief of Cardiology, Director of Cardiac Rehabilitation, and Director of Medical Education.

In both Canada and the United States a large number of students are complaining that they feel unwell in classrooms that have Wi-Fi technology. These complaints have been investigated and what emerges is the following:

1. Symptoms common among these students include headaches, dizziness, nausea, feeling faint, pulsing sensations or pressure in the head, chest pain or pressure, difficulty

concentrating, weakness, fatigue, and a racing or irregular heart accompanied by feelings of anxiety. These symptoms may seem diverse but they indicate autonomic dystonia or dysfunction of the autonomic nervous system.

2. Symptoms do not appear in parts of the school that do not have this technology (Wi-Fi-free portables) and they do not appear in homes that do not have wireless technology.

3. We know that the heart is sensitive to and can be adversely affected by the same frequency used for Wi-Fi (2.4 GHz) at levels a fraction of federal guidelines (less than 1%) and at levels that have been recorded in two Ontario schools with Wi-Fi technology.

4. The incidence of sudden cardiac arrests (SCA) among young athletes is increasing and doctors don't know why. In one small Ontario community, the number of students experiencing SCA is disturbingly high. Whether WiFi and nearby cell phone antennas exacerbate SCA needs to be investigated further before students are subjected to these fields.

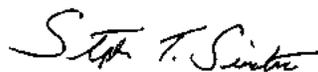
In conclusion it is unwise to install wireless technology (WiFi) in schools. We do not know what the long-term effects of low-level microwave radiation are on students and teachers. The safety of this technology on children has not been tested and I would advise that you follow the precautionary principle that states the following:

"In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

(Rio Conference 1992).

The principle implies that we have a social responsibility to protect the public from exposure to harm, when scientific investigations have found a plausible risk. That "plausible risk" exists for microwave radiation at very low levels. These protections can be relaxed only if further scientific findings emerge that provide sound evidence that no harm will result. In some legal systems the application of the precautionary principle has been made a statutory requirement.

Sincerely,



Stephen T. Sinatra, M.D., F.A.C.C., F.A.C.N., C.N.S



Karolinska Institutet
Department of Neuroscience
Experimental Dermatology Unit

Stockholm, July 24, 2014

Mr. Thomas McKean, President, Board of Trustees
Mr. James Shay, President-Elect, Board of Trustees
Fay School
48 Main Street
Southborough, MA 01772

Ladies and Gentlemen,

It has been brought to my attention that children in your school are physically being impacted by radiation from WiFi antennas, and that some of the student's reactions have been severe. I was concerned to learn this. It is unwise to chronically expose children to this type of radiation, as their bodies are more sensitive than adults and the radiation has been shown to impair not just physiological functioning but cognitive function and learning.

Radiation of the kind emitted by WiFi transmitters impacts attention, memory, perception, learning capacity, energy, emotions and social skills. There is also diminished reaction time, decreased motor function, increased distraction, hyperactivity, and inability to focus on complex and long-term tasks. In some situations, children experience cardiac difficulties. In one Canadian school district, incidence of cardiac arrest in children was 40x the expected rate, and defibrillators have had to be placed at each school. Online time, particularly multi-tasking in young children, has been linked with a chronically distracted view of the world preventing learning critical social, emotional and relational skills. There is a physiological as well as psychological addiction taking place. I am sure, that as stewards of the lives of the children in your charge, you would not wish any of these outcomes.

Given the large and growing body of science indicating biological and health effects from the radiation emitted by antennas, it would be most imprudent at this time to permit wireless antennas on—or inside—your property. Understand the FCC exposure guidelines only protect against the acute power density, or acute thermal, effects, and they do nothing to protect against the other aspects of the radiation's risk, such the frequencies, amplitude, pulsing, intensity, polarity and biologically disruptive information content. Thus, until the FCC establishes guidelines for the non-thermal effects, any reliance by your school on current FCC guidelines, based solely on *thermal effects* would necessarily be incomplete. I urge a school of your caliber to be a leader on this issue, and appreciate that two wrongs do not make a right.

I enclose for your review the transcript of the Seletun Scientific Statement laying out the key concerns on this topic. If I can be of further help, please, do not hesitate to be in touch.

Yours truly,

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CC: cheemf@lists.healthandenvironment.org

Sent: 2/8/2013 2:21:54 P.M. Pacific Standard Time

Subj: [cheemf] Adoption of Wi-Fi in Los Angeles USD classrooms

TO: Los Angeles Unified School District (LAUSD)

FROM: Joel M. Moskowitz, Ph.D.

Director, Center for Family and Community Health

School of Public Health

University of California, Berkeley

RE: Adoption of Wi-Fi in Classrooms

DATE: February 8, 2013

Based upon my review of the research of the health effects associated with exposure to radiofrequency (RF) electromagnetic radiation (EMR), especially microwave radiation, I feel compelled to register my concern that adoption of Wi-Fi in LAUSD classrooms is likely to put at risk the health of many students and employees in the District.

In December, Dr. Gayle Nicoll of URS Corporation asked me to serve as an expert reviewer for a report that URS prepared for the LAUSD regarding the adoption of Wi-Fi in classrooms. Since Ms. Nicoll could not assure me that URS has no conflicts of interest, I turned down her request and sent her references to recent studies about Wi-Fi radiation. I cc:ed Board members and key staff as I was concerned about the health risks of unnecessarily subjecting 660,000 children to 13,000 hours of Wi-Fi microwave radiation during their K-12 school years.

Although I have not seen the URS report, I imagine it is based on the FCC's outmoded 1996 safety standards which only protect the public from the **thermal risk of RF EMR exposure** (i.e., from heating of tissue). For the past three years, in numerous media interviews I have been calling on the FCC to strengthen its standards and testing procedures to protect the public and workers from the low-intensity, **non-thermal risks of RF EMR exposure** that have been reported in hundreds, if not thousands, of research studies. These include increased risk of neurological and cardiovascular problems, sperm damage and male infertility, reproductive health risks, and cancer.

The **precautionary principle** should be applied to this critical policy decision. This principle, developed at a U.N. environmental conference in 1992 states that in the absence of scientific consensus if an action has a suspected risk of causing harm, the burden of proof it is not harmful falls on those taking the action, and all reasonable measures to reduce the risk must be taken.

Internet access can be provided to students through wires or optical fiber without installing Wi-Fi in the classrooms.

For further information, please see my **Electromagnetic Radiation Safety web site** at <http://saferemr.blogspot.com> where I have archived news releases and links to recent reports by major scientific groups and political agencies.

Sincerely,

Joel M. Moskowitz, Ph.D.

=====

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December 1, 2015

Montgomery County Schools
Carver Educational Services Center
850 Hungerford Drive
Rockville, MD 20850

Attention: Dr. Andrew Zuckerman, Chief Operating Officer
MCPS Board of Education Members

This letter of comment has been prepared after reviewing the *Montgomery County Public Schools Radiofrequency (RF) Summary Monitoring Report* dated July 2015 produced by AECOM Environment.

1) The instrument cited as being used for the peak measurements in section 7, a Narda SRM-3006, is not suitable to measure the very short (1 millisecond) spikes typically found in WiFi 802.11n communication. As stated on page 7-1, each data sweep takes 550 milliseconds, making the instrument unsuitable for reliably logging the short bursts typical in 802.11n WiFi communications. Palit et al conclude that 50% of the uplink traffic will be in bursts shorter than 2 milliseconds. The peak levels of those packets will not be reliably logged by a device with a 550 millisecond sweep time.

Palit et al, 2012. Anatomy of WiFi Access Traffic of Smartphones and Implications for Energy Saving Techniques. International Journal of Energy, Information and Communications, Vol. 3, Issue 1.

2) Even the average-level tests seem inconsistent with engineering reality. Figure 7.1 shows a background noise level mostly flat between 2.4GHz and 5.8Ghz. That noise (typically -70dBm) is generally consistent with the internal thermal noise in a quality wide-band measuring instrument. Two tiny peaks out of that noise are represented to be the "average electric field generated at one foot away from an AP in use at Beverly Farms Elementary School." Even with just the 802.11n beacon-frame idling, the peak field a foot away from an access point should be a million times higher than the levels of figure 7.1. Why do we just see a blip on the chart? Clearly some unusual 'averaging' has occurred, yet the parameters of that averaging, and the potential clinical implications of that averaging, are not noted in the annotation to the Figures. Further, Figure 7.2 shows a background noise level some 10dB higher than figure 7.1, something that would be very unusual in measurements at these Gigahertz frequencies.

3) The RF exposure estimates are additionally inadequate because, in reality, there is no way to meet the distancing that AECOM's report bases its measurements on for an individual student. In normal use, kids hover over devices. They hug them to the body. They put them in their laps at lunchtime, on the couch and in bed doing homework. It is entirely unrealistic to expect teachers and parents to guarantee that students always keep their Chromebooks at some arbitrary distance during use.

4) The report concludes with classroom RF measurement comparisons to an outdated 2007 BioInitiative Report recommendation of 0.1 uW/cm². (Section 7). Graphics need to be re-drawn with comparisons to the 2012 recommended BioInitiative level, and do so not only for a 12” spacing, but also for the one-inch distance measured from the Chromebook (Figure 7-3 and 7-4). Using an arbitrary 12” distance to report and compare to either the 2007 or 2012 BioInitiative recommendations will seriously underestimate RF exposures since students don’t always (or even typically) maintain a foot of distance. Their ‘leaning in’ and having to place their faces close to the device is common usage, and is unavoidable.

5) The methodology is not specific as to the number of operating devices and clustering of students at work – which is necessary to characterize exposures from a room full of operational wireless devices. Figure 2.1 shows multiple wireless devices connected to one wireless router. Measuring one or several Chromebooks rather than one Chromebook for each of the 25-35 students plus router isn’t how a normal classroom operates. **It does not** produce RF measurements of a typical class using many wireless devices at once, so this is a fundamental flaw. It will underestimate RF exposures.

6) There is also a comment to be made here about the setup – how does this methodology reasonably reflect how smaller or younger children with short arms and torsos actually use tablets? What RF exposures they can expect to receive? The likely consequence to the measurements is greater exposure. Unless the students are using chopsticks instead of their fingers, or are using wired keyboards that increase the distance to the wireless device, RF exposures will be worse for the younger or smaller-stature students.

7) This Report appears to legitimize MCSD’s use of wireless in the classroom by asserting compliance with the 2007 BioInitiative Report recommendation, yet the report does not mention the significant revision of that threshold in the years between 2007 and 2012. Both BioInitiative Reports clearly state that their recommendations are interim and ‘that they may have to go lower.’ Recent studies of students reporting headache, irritability, concentration and behavior problems at levels as low as 0.003-0.006 uW/cm², indicate that neither BioInitiative Report threshold may be low enough to assure safety. As the co-editor of the BioInitiative Reports, and a founding member of the BioInitiative Working Group, the way in which our work has been invoked is not consistent with the findings of the BioInitiative Reports overall. The conclusions of this report cannot be said to give a positive assertion of safety because of the degree of uncertainty over whether the testing equipment was adequate (we believe it was not); the lack of comparison data; and the failure to measure RF exposures at realistic distances from the student(s).

8) Correct BioInitiative citations are:

BioInitiative Working Group, Cindy Sage and David O. Carpenter, Editors. BioInitiative Report: A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Radiation at

www.bioinitiative.org, December 31, 2012.

BioInitiative Working Group, Cindy Sage and David O. Carpenter, Editors. BioInitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF) at www.bioinitiative.org, August 31, 2007

CONCLUSION

The data in this report cannot therefore be used to infer safety, or lack of safety, of children in any of the tested locations.

Respectfully submitted,

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September 22, 2014

On behalf of the BioInitiative Working Group, we are writing to express our concern about the views expressed by CEOs from Google, Dell, Apple, Adobe, eBay, Facebook, the George Lucas Educational Foundation and others to the FCC supporting wireless technologies in schools.

Your letter to the FCC dated July 7, 2014 titled Education Superhighway, states:

“Today, we are writing to you to urge swift bi-partisan action at your July 11, 2014 meeting to adopt the E-Rate modernization proposal set forth by Chairman Wheeler.”
“By responsibly investing \$2 billion of unused funds and providing predictable ongoing support for Wi-Fi, the plan will make dramatic progress in bringing high-speed connectivity to our classrooms.”

No one denies that bringing high-speed connectivity to our classrooms is important. But it can be a wired connection and does not have to be WiFi. It does not reflect well on the ethics of your corporations to encourage the FCC to provide \$2 billion dollars for new wireless classroom infrastructure and devices for school children, knowing that wireless emissions have been classified as a Possible Human Carcinogen by the World Health Organization’s International Agency for Research on Cancer (2011). To promote wireless technologies in schools is to deliberately and knowingly disregard current health warnings from international science and public health experts.

Saturating schools with wireless technology will likely create unnecessary liability for municipalities and result in a loss of public trust and confidence in the corporations that push their wireless products with a blind eye toward health concerns.

Epidemiological studies show links between radiofrequency radiation (RFR) exposure and cancers, neurological disorders, hormonal changes, symptoms of electrical hypersensitivity (EHS) and more. Laboratory studies show that RFR exposure increases risk of cancer, abnormal sperm, learning and memory deficits, and heart irregularities. Fetal exposures in both animal and human studies result in altered brain development in the young offspring, with disruption in learning, memory and behavior. The brain development of a fetus can be impaired by in-utero exposure to a pregnant woman. The evidence for these statements is based on hundreds of published, peer-reviewed scientific studies that report adverse effects at levels much lower than current FCC public safety limits. WiFi in schools, in contrast to wired internet connections, will increase risk of neurologic impairment and long-term risk of cancer in students. Corporations cannot avoid responsibility simply by asserting compliance with existing legal, but outdated and inadequate FCC public safety limits.

Today, corporations that deal with educational technology should be looking forward and helping school administrators and municipal leaders to access safe, wired solutions. Your corporations can reasonably foresee and offer alternatives to potentially hazardous exposures to wireless radiation by choosing to support wired educational technologies.



Thank you for your attention to this letter.

Cindy Sage, MA, Tel: (805) 969-0557 Email: sage@silcom.com
David O. Carpenter, MD, Tel: 518-525-2660 Email: dcarpenter@albany.edu
Co-Editors, BioInitiative 2012 Report
For the BioInitiative Working Group

Copies: CEOs signing Education Superhighway letter to the FCC
Federal Communications Commission
The White House, President Obama
US Secretary of Education Secretary Arne Duncan

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May 13, 2013

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Open Letter to the Superintendents
of the School Districts of the United States

The American Academy of Environmental Medicine (AAEM) strongly supports the use of wired Internet connections.

The AAEM comprises Medical Doctors, Osteopaths, and PhD researchers focusing on the effects of environmental agents on human health. For forty years the Academy has trained Physicians to treat the most difficult patients who are often overlooked by our medical system, because the cause of their illness, rather than being caused by an infection or traditionally understood cause, is related to more basic underlying causes such as chemical, toxic metal, food or radiation exposures.

In May 2011 the World Health Organization elevated exposure to wireless radiation, including WiFi, into the Class 2b list of Carcinogens.

There is consistent emerging science that shows people, especially children who are more vulnerable due to developing brains, and thinner skulls, are affected by the increasing exposure to wireless radiation. In September 2010, the Journal of the American Society for Reproductive Medicine-Fertility and Sterility, reported that only four hours of exposure to a standard laptop using WiFi caused DNA damage to human sperm.

In December 2012 the American Academy of Pediatrics- representing 60,000 pediatricians, wrote to Congress requesting it update the safety levels of microwave radiation exposure especially for children and pregnant women.

In a school setting, children are exposed to WiFi for an unprecedented period of time, for their entire childhood. Some of these signals will be much more powerful than is received at home, due to the need for the signals to go through walls, and serve multiple computers simultaneously. The school signals are dozens of times more powerful than the café and restaurant systems.

To install this system in your school district risks a widespread public health hazard that the medical system is not yet prepared to address. Statistics show that you can expect to see an immediate reaction in 3% and delayed effects in 30%, including teachers.

It is better to exercise caution and substitute with a safe alternate such as a wired connection, which is not classified as a possible Carcinogen. While more research is being conducted children must be protected. Wired technology is not only safer, it also stronger and more secure.

While the debate ensues about the dangers of WiFi, cell phone towers and cell phones, it is the doctors who must deal with the after affects. Until we can determine why some get sick and others do not, and some are debilitated for indeterminate amounts of time, we implore you to not take the risk, with the health of so many children who have entrusted you to keep them safe while at school.

Respectfully,

The Executive Committee of the American Academy of Environmental Medicine

Message to Schools and Colleges about Wireless Devices and Health

If wireless devices, such as Wi-Fi, are used in your schools and colleges, then the health of your students, your faculty, and your staff can be at risk. This is a difficult problem but an addressable one if you act.

Background: Wireless devices transmit information using radiofrequency/microwave radiation. The international biomedical research community has been studying the biological impact of such radiation for decades, but more intensely in recent years. Thousands of peer-reviewed studies published in biomedical research journals have contributed to our understanding of this impact. So many serious biological effects have been found that immediate responsive action is warranted. Further, these biological effects are occurring at levels of radiation far lower than earlier understood. Simply stated, a worldwide health crisis is emerging and is becoming a hallmark of the 21st Century. The international biomedical research community is trying to warn us; but we, in the USA, are not yet listening. I hope this message will help to change that.

As a scientist, I urge you to look into the **health impact of the radiofrequency/microwave radiation** produced by wireless devices. Examples of wireless devices of concern in our environment are Wi-Fi in all of its forms; cell phones and cell towers (especially those located on school grounds); cordless phones; wireless computers, whether desktop, laptop, or tablet versions; wireless baby monitors; wireless smart electricity meters; emerging wireless smart appliances; and microwave ovens (because they always leak radiation).

This crisis is the consequence of many factors. Here are some of them:

- All living things are bioelectrical in nature. That is why electrocardiograms and electroencephalograms work. They, of course, measure the tiny electrical signals that operate the heart and the brain. The critical tasks performed by these tiny electrical signals, and so many other electrical signals in all living things, can be disrupted by radiofrequency/microwave radiation.
- The levels of manmade radiofrequency/microwave radiation in our environment are increasing exponentially and already exceed, by many orders of magnitude, the levels at which all life on Earth evolved. Simply stated, we are drowning in a rising sea of manmade radiofrequency/microwave radiation.
- The invisible nature of radiofrequency/microwave radiation leaves the public and the decision-makers unaware of the rising levels of radiation around them.
- The genuine usefulness of wireless devices promotes denial of the risks.
- The intense advertising, the economic power, and the political power of profitable wireless industries enable them to dominate the public dialogue and to hold sway over government regulators and legislators.
- Current Federal standards for limiting the exposure of the public to radiofrequency/microwave radiation are outdated and overly permissive. Those standards are based on thermal heating alone. In effect, the Government claims that if you are not cooked too much by the radiation, then you are fine. Those Federal standards ignore the many biological effects that occur at much lower levels of radiation, leaving the public unprotected.
- Federal and state governments are advocating unlimited expansion of wireless technology, and are even co-funding such expansion and mandating the acceptance of wireless technology by the public. Such

actions reflect a widespread lack of understanding of, or willful blindness to, the underlying science and its consequences for public health.

- Some of the more serious consequences of exposure to radiofrequency/microwave radiation (such as DNA damage, cancer, and infertility) are especially nefarious because they give no early warning signs.
- Other consequences of exposure do give early warning signs (such as sleep disruption, headaches, fatigue, ringing in the ears, memory loss, dizziness, heart arrhythmia, and many others); but those signs are too often dismissed because they can have other causes as well, complicating identification of the true cause.
- The absence of routine training of physicians in the biological effects of radiofrequency/microwave radiation makes it difficult for physicians to identify the causes and to provide responsive guidance.
- Even aware individuals cannot control their exposure in any environment shared with others, because the radiation around them, much like second-hand smoke, is forced on them by unaware individuals. Only governments can fully solve this problem, but they are currently part of the problem. For now the public will have to protect itself, and that will require public education and action.

Fortunately, many of the services that wireless devices offer can be realized with much safer wired devices. The wired devices achieve connectivity with fiber-optic, coaxial, or Ethernet cables. The wired devices are faster, more reliable, and more cyber secure. They are, however, less mobile, often less convenient, and somewhat more expensive to install. But those drawbacks pale in comparison to the benefits of good health.

Simply stated, schools and colleges can protect their students, staff, and faculty from the health risks posed by wireless devices, including Wi-Fi, by converting to safe wired connectivity. If your institution lacks the resources to convert now, do consider shutting down your wireless devices anyway and converting as soon as you can. You can advance learning without leaving a trail of illness behind you, some of which can be lifelong.

As a suggested starting place for exploring the concerns about the radiation from wireless devices, I have appended an “Annotated List of References” and an “Annotated List of Videos”. Please view, especially, video (1) called “Wi-Fi in Schools, the Facts”, made in Australia, on page 6.

Regards,

Ronald M. Powell, Ph.D.
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My background

I am a retired U.S. Government scientist (Ph.D., Applied Physics, Harvard University, 1975). During my Government career, I worked for the Executive Office of the President, the National Science Foundation, and the National Institute of Standards and Technology. For those organizations, respectively, I addressed Federal research and development program evaluation, energy policy research, and measurement development in support of the electronics and electrical-equipment industries and the biomedical research community. I currently interact with other scientists and with physicians around the world on the impact of the environment – including the radiofrequency/microwave environment – on human health.

ANNOTATED LIST OF REFERENCES

The international biomedical research community has conducted thousands of studies seeking to identify the biological effects of exposure to both low frequency and radiofrequency electromagnetic fields, extending into the microwave region. So many serious biological effects have been found from such fields, at levels earlier thought to be low enough to be safe, that immediate action is needed to alert and protect the public.

The most massive review of this biomedical literature is the 1479-page BioInitiative 2012 Report which considered about **1800** biomedical research publications, most issued in the previous five years. The BioInitiative 2012 Report was prepared by an international body of 29 experts, heavy in Ph.D.s and M.D.s, from 10 countries, including the USA which contributed the most experts (10). The review concludes that "The continued rollout of wireless technologies and devices puts global public health at risk from unrestricted wireless commerce unless new, and far lower[,] exposure limits and strong precautionary warnings for their use are implemented."

BioInitiative Working Group, Cindy Sage, M.A. and David O. Carpenter, M.D., Editors, BioInitiative Report: A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Radiation, December 31, 2012

<http://www.bioinitiative.org>

A group of six doctors in Oregon, led by Paul Dart, M.D., released, in June 2013, a 74-page review of **279** biomedical research publications. This review makes the health case against "cell phones, base stations, Wi-Fi, Smart Meters and other RF [*radiofrequency*] or ELF [*extremely low frequency*] -emitting devices". The review notes that "The current levels of exposure need to be reduced rather than increased further. The FCC [*Federal Communications Commission*] must especially protect vulnerable groups in the population including children and teenagers, pregnant women, men of reproductive age, individuals with compromised immune systems, seniors, and workers." This review is posted on the website of the FCC at the link entitled "Health Effects of RF - Research Review (87)".

Biological and Health Effects of Microwave Radio Frequency Transmissions, A Review of the Research Literature, A Report to the Staff and Directors of the Eugene Water and Electric Board, June 4, 2013

<http://apps.fcc.gov/ecfs/comment/view?id=6017465430>

Michael Bevington, in 2013, published a book that summarizes the findings of **1828** international biomedical research publications. The book describes the symptoms caused by exposure to electromagnetic radiation, the many diseases associated with such exposure, and the relative risk levels associated with specific sources of electromagnetic radiation. The citations of papers include the PMID index numbers for easy location on the PubMed.gov website of the National Institutes of Health. This website provides the largest index to the biomedical research literature in the world.

Electromagnetic Sensitivity and Electromagnetic Hypersensitivity: A Summary by Michael Bevington
NEW EDITION: March 2013

<http://www.es-uk.info>

About 200 scientists from 39 countries around the world submitted an international appeal to the United Nations and to the World Health Organization in May 2015. These scientists seek improved protection of the public from harm from the radiation produced by many wireless sources, including "cellular and cordless phones and their base stations, Wi-Fi, broadcast antennas, smart meters, and baby monitors" among others.

Together, these scientists have published over 2000 peer-reviewed research papers on this subject.

<https://www.emfscientist.org/index.php/emf-scientist-appeal>

The International Agency for Research on Cancer, of the World Health Organization, has already classified radiofrequency electromagnetic fields as a Class 2B carcinogen ("possible carcinogen"), based primarily on the increased risk of brain cancer. That decision was made in 2011. Since then, the research supporting a higher classification of risk ("probable carcinogen", or even "known carcinogen") has continued to build.

http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf

The American Academy of Environmental Medicine (AAEM), which trains physicians in preparation for Board Certification in Environmental Medicine, states: "The AAEM strongly supports the use of wired Internet connections, and encourages avoidance of radiofrequency such as from WiFi, cellular and mobile phones and towers, and 'smart meters'." AAEM further states that "The peer reviewed, scientific literature demonstrates the correlation between RF [*radiofrequency*] exposure and neurological, cardiac, and pulmonary disease as well as reproductive and developmental disorders, immune dysfunction, cancer and other health conditions. The evidence is irrefutable." The AAEM concludes: "To install WiFi in schools plus public spaces risks a widespread public health hazard that the medical system is not yet prepared to address."

AAEM, Wireless Radiofrequency Radiation in Schools, November 14, 2013

<http://www.aaemonline.org/pdf/WiredSchools.pdf>

The American Academy of Pediatrics (AAP), whose 60,000 doctors care for our children, supports the development of more restrictive standards for radiofrequency radiation exposure that would better protect the public, particularly the children. The AAP, in a letter to the Federal Communications Commission (FCC) and the Food and Drug Administration (FDA), dated August 29, 2013, states that "Children are not little adults and are disproportionately impacted by all environmental exposures, including cell phone radiation. Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children. It is essential that any new standard for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded throughout their lifetimes."

<http://apps.fcc.gov/ecfs/document/view?id=7520941318>

The U.S. Government bears a major responsibility for the exponential growth in the levels of radiation from wireless devices in the environment. In 1996, the U.S. Congress passed, and the President signed, the Telecommunications Act of 1996. Under pressure from the cell phone industries, this law included this provision: "No State or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities [*cell towers*] on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the [*Federal Communications*] Commission's regulations concerning such emissions." Because the Federal Communications Commission's regulations on radiation exposure are so permissive, this provision prevents state and local governments from protecting their people from radiation from cell towers, based on health concerns.

Telecommunications Act of 1996

<https://transition.fcc.gov/Reports/tcom1996.pdf>

The Federal Communications Commission (FCC) has acted in partnership with the wireless industries by permitting wireless radiation levels far higher than the biomedical research literature indicates are necessary to protect human health. The success of the wireless industries in capturing the FCC, the committees in the U.S. Congress that oversee the FCC, and the Executive Branch is detailed in a new monograph from the Center for Ethics at Harvard University. As an example of that capture, the President recently appointed, as head of the FCC, the former head of the CTIA – The Wireless Association, which is the major lobbying organization for the wireless industry. This, of course, is the infamous "revolving door".

Norm Alster, Captured Agency: How the Federal Communications Commission is Dominated by the Industries It Presumably Regulates (2015)

<http://ethics.harvard.edu/news/new-e-books-edmond-j-safra-research-lab>

Further, the U.S. Government's "American Recovery and Investment Act of 2009" provided funding that was used to motivate the installation of wireless smart meters (also called the "Advanced Metering Infrastructure" or "AMI") by offering cost sharing, in the form of grants, to the utilities that would adopt such meters.

https://www.smartgrid.gov/recovery_act/overview/smart_grid_investment_grant_program.html

Many states then extended the impact of the above Act by *mandating* the acceptance of wireless smart meters by the public. These meters contain microwave transmitters/receivers and are placed either on, or inside, every home and many businesses. A California court-ordered document indicates that each smart meter broadcasts bursts of radiation, on average about 10,000 times per day and up to a maximum of about 190,000 times per day. Such bursts flood neighborhoods with radiation, day and night, throughout the year.

http://emfsafetynetwork.org/wp-content/uploads/2011/11/PGERFDataOpt-outalternatives_11-1-11-3pm.pdf

Increasingly, the public is becoming aware of the threat that wireless radiation poses to health. The initial opposition focuses primarily on *mandated* sources of exposure, especially when the individuals exposed include the unborn and young children as they are among the most vulnerable. Thus, the strongest initial opposition is surfacing for cell towers, especially on school grounds; for Wi-Fi in schools and colleges; and for wireless smart meters placed on, or inside, homes and businesses. Most states now have opposition groups, and some states have even 10 or 20 such groups. These groups are pursuing relief through state regulatory bodies, through state legislatures, and through the courts. Below is a sampling of the hundreds of U.S. websites that reflect the nature and scope of the opposition to the unbridled expansion of wireless technology. Such websites seek to educate the public and decision-makers, and thus to promote responsive action, based on the underlying science.

The BabySafe Project

<http://www.babysafeproject.org/the-science/>

National Association for Children and Safe Technology

<http://www.nacst.org/>

Stop Smart Meter's listing of groups in the USA and other countries opposed to wireless smart meters

<http://stopsmartmeters.org/frequently-asked-questions/contacts-database/>

Smart Grid Awareness, a Website by SkyVision Solutions, Consumer Protection Advocate

<http://smartgridawareness.org>

ANNOTATED LIST OF VIDEOS

There are hundreds of videos on the Internet that address the impact of wireless radiation on health. Here are just a few that provide an especially good introduction to this topic. An Internet search will surface many more.

(1) An introduction to the health risks posed by Wi-Fi in schools

Wi-Fi in Schools, the Facts (September 9, 2013) (18 minutes)

Produced by Wi-Fi in Schools Australia.

<https://www.youtube.com/watch?v=QQryZbxlgXI&feature=youtu.be>

(2) Wide ranging overview of the impact of electromagnetic radiation on human health, particularly at microwave frequencies, with a special emphasis on children and the school environment

Electromagnetic Radiation Health for Children 2014 (70 minutes)

Presented by Dr. Erica Mallery-Blythe, a UK physician.

<https://www.youtube.com/watch?v=sNFdZVeXw7M>

(3) Documentary on the wireless industry's efforts to suppress public awareness of the health effects of wireless radiation

Microwaves, Science & Lies (2014) (90 minutes)

Produced by Jean Heches and Nancy de Meritens of France.

<https://vimeo.com/ondemand/17755/89417454>

(4) Samples of video testimony by individuals harmed by the radiation from wireless devices

Cell Phones Cause Cancer (October 17, 2012) (9 minutes)

Presented by Jimmy Gonzalez, Esq.

<https://www.youtube.com/watch?v=DIIQVJd0IA8>

Woman suffers acute radiation exposure from a bank of smart meters (January 21, 2015) (3 minutes).

Produced by Maryland Smart Meter Awareness.

<https://www.youtube.com/watch?v=F9QZuWPw6Y0&feature=youtu.be>

Man experiences adverse health effects from exposure to a smart meter (March 7, 2013) (3 minutes).

Presented by Garic Schoen of Gaithersburg, MD.

Produced by Maryland Smart Meter Awareness.

<http://marylandsmartmeterawareness.org/smart-meter-news/maryland-ms-resident-testimony-to-economic-matters-committee-re-hb1038-on-march-14-2013/>

Individuals with high sensitivity to the radiation from wireless devices search for increasingly rare safe electromagnetic environments.

Searching for a Golden Cage (May 8, 2014) (13 minutes)

Produced by Nadav Neuhaus.

<http://time.com/golden-cage/>

Patrons:

Prof. Declan Kennedy
Prof. Vyvyan Howard
Prof. Risteard Mulcahy



7th January, 2013

Dear Principal,

The Irish Doctors Environmental Association (IDEA) has very serious concerns in relation to the ubiquitous use of Wi-Fi in Irish schools, and alerts you to the warnings of many leading international scientists and medical doctors who believe Wi-Fi is harmful to health, especially children's health.

<http://wifiinschools.org.uk/resources/safeschools2012.pdf>

Wi-Fi is an unregulated technology and there is absolutely no evidence that it is safe.

Since May 31st, 2011, radiofrequency electromagnetic fields (as in Wi-Fi) have been classified by the World Health Organisation as 'possibly carcinogenic' to humans. The IDEA unequivocally supports the Council of Europe, The European Environmental Agency and The International Commission for Electromagnetic Safety (ICEMS) in urging the adoption of the Precautionary Principle to protect human health.

Warnings by Scientists and Doctors:

<http://www.iemfa.org/index.php/appeals>

The Precautionary Principle has already been adopted by a number of Governments and agencies internationally.

Governments & organisations banning and warning against Wi-Fi:

http://www.cellphonetaskforce.org/?page_id128

While we fully support the promotion of technology in education we urge you to use wired technologies for your own safety and that of your pupils and staff. The tragedy of avoidable illness is only superseded by the knowledge that it could have been avoided.

Yours sincerely

Elizabeth Cullen M.B. B.Ch. B.A.O. M.Sc. Ph. D

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Philip Michael M.B. B.Ch. B.A.O. D.C.H. MICGP

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www.isde.org
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www.noharm.org

Linked officially with WHO -
World Health Organisation

Affiliated to International
Physicians for the Prevention
of Nuclear War - IPPNW
(Nobel Prize Winner 1985)

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April 9, 2014

Via email: rec@harlanglaw.dk

Dear members of The Committee on Radiation Protection/Komitéen for Strålebeskyttelse:

My name is Frank Clegg and I am the CEO of Canadians for Safe Technology, C4ST, a volunteer based, national organization which promotes the safe use of wireless technology.

In my previous role as President of Microsoft Canada, I witnessed the incredible benefits that technology can provide. I also witnessed the potential harmful effects if technology is not implemented safely. Though wireless technologies afford schools various advantages, this solution cannot overshadow the evidence which demonstrates cause for concern. I request that you consider the following important facts.

The Canadian Teachers' Federation (CTF) is a national alliance of provincial and territorial teacher organizations that represent nearly 200,000 elementary and secondary school teachers across Canada. In their submission to the public consultation of the Royal Society of Canada, Oct. 28, 2013, they submitted the following recommendations. (Safety Code 6 is Health Canada's guideline regarding the limits of radiation from wireless devices).

Recommendations...

... That Safety Code 6 include a recommendation for prudent use of Wi-Fi whenever possible including the recommendation to limit consistent exposure in schools by turning off wireless access points when not in use. ...

That Safety Code 6 exposure thresholds be based upon both thermal and biological effects of exposure to Wi-Fi.

... That the Expert Panel recommend an education program regarding the relative safety of Wi-Fi exposure and that appropriate resources be developed to educate the public regarding ways to avoid potential exposure risks of Wi-Fi access points and devices.

As reported by CBC News on Aug. 17, 2013, <http://www.cbc.ca/news/canada/toronto/story/2013/08/17/toronto-cell-phone-ban.html> "The Elementary Teachers' Federation of Ontario has updated its policy position on the student use of personal electronic devices, preferring for them to be turned off and put away unless a teacher says otherwise. That policy, which was amended at the union's annual general meeting, informs ETFO in its discussions with the government and school boards on related issues. A portion of that policy now states that such devices, which include cellphones, should "be stored and turned off during the instructional day unless their use is directly authorized by staff." In a separate resolution, ETFO voted to study the effects of non-ionizing electromagnetic radiation, the potentially harmful radiation emitted by cellphones. A report is due on the matter in February."

In a letter to the Peel Region, April 22, 2013, The American Academy of Environmental Medicine stated "To install this widespread wireless internet access system in Peel District schools risks a widespread public health hazard that the medical system is not yet prepared to address. Statistics show that you can expect to see an immediate reaction in 3% and delayed effects in 30%, including teachers."

In 2012, the BC Confederation of Parent Advisory Councils passed resolution 18 which states: "BCCPAC call on Boards of Education to cease to install Wi-Fi and other wireless networks in schools where other networking technology is feasible."
<http://www.bccpac.bc.ca/resolutions/wi-fi-classrooms-committee-report>

In May 2011, the World Health Organization (WHO) announced that the radiation emitted from wireless devices, including Wi-Fi, is a Class 2B carcinogen, which falls into the same category as lead and DDT.

You may already be aware that some schools and libraries in France and Switzerland have already removed Wi-Fi due to the suspected harmful health effects.

The Council of Europe, which includes 47 countries, adopted resolution 1815 which suggests in member countries "give preference to wired Internet connections, and strictly regulate(s) the use of mobile phones by schoolchildren on school premises."

The European Parliament (EU) resolutions 2008/2211(INI) & 2007/2252(INI,) state: "wireless technology (mobile phones, Wi-Fi / WiMAX, Bluetooth, DECT landline telephones) emits EMFs that may have adverse effects on human health... particularly to young people whose brains are still developing... **the limits on exposure to electromagnetic fields which have been set for the general public are obsolete.**" (emphasis in original)

Other countries such as Israel, Russia, Switzerland, Frankfurt, Bavaria, and Salzburg have followed suit making the difficult decision to use hard wired connections as well. Recently, France passed a law recommending hard wired technology in schools.

The Austrian Medical Chamber shares that “WiFi may lead to concentration difficulties and memory problems in certain individuals.” The Austrian Medical Association recommends Wi-Fi free school environments.

The International Society of Doctors for the Environment (ISDE) and Irish Doctors Environmental Association (IDEA) advises to “Avoid Wi-Fi in home or work if possible, particularly in schools or hospitals. Use wired technology whenever possible” sharing that: “Because of the potentially increased risks for the fetus, infants and young children due to their thinner more permeable skulls and developing systems, particularly the immune and neurological systems, based on the precautionary principal and on the mounting evidence for harm at the sub-cellular level, we recommend that EMR exposure should be kept to a minimum.”

The American Academy of Pediatrics (AAP) - 60,000 Pediatricians and Pediatric Surgeons calls for caution as well stating that “The differences in bone density and the amount of fluid in a child’s brain compared to an adult’s brain could allow children to absorb greater quantities of RF energy deeper into their brains than adults... the current exposure limits may not reflect the latest research on RF energy” and lends support to removing Wi-Fi from schools as well.

As stewards of the public trust, I urge you to ensure the safest possible learning environment for the students in your care and to set an example for school districts by removing Wi-Fi and adopting “Best Practices” which limit the use of other wireless technologies.

Sincerely,



Frank Clegg
CEO,
Canadians for Safe Technology (C4ST)
frank@c4st.org

cc: Susanne Hansen, sh.klodskov@gmail.com

28 February 2011

Chairman and Trustees
Kawartha Pine Ridge District School Board
Education Centre
1994 Fisher Drive
Peterborough, Ontario K9J7A1

Dear Sirs/Madams:

This is concerning potential adverse health effects associated with exposure to radiofrequency (RF) radiation, specifically that from wireless routers. I am a public health physician who has been involved in issues related to electromagnetic fields (EMFs) for a number of years. I served as the Executive Secretary for the New York Powerline Project in the 1980s, a program of research which showed that children living in homes with elevated magnetic fields coming from powerlines suffered from an elevated risk of developing leukemia. I have edited two books on effects of EMFs, including RF radiation. I served as the co-editor of the Bioinitiative Report (www.bioinitiative.org), a comprehensive review of the literature on this subject. The public health chapter from this report was subsequently published in a peer reviewed journal, and that is attached. Also I testified before the President's Cancer Panel on this subject in 2009, and a publication coming from that testimony is also attached. Thus this is a subject which I know well, and one on which I take a public health approach that has as a fundamental principle the need to protect against risk of disease even when one does not have all the information that would be desirable.

There is clear and strong evidence that intensive use of cell phones increases the risk of brain cancer, tumors of the auditory nerve and cancer of the parotid gland, the salivary gland in the cheek by the ear. The evidence for this conclusion is detailed in the attached publications. WiFi uses similar radiofrequency radiation (1.8 to 5.0 GHz), although the intensity of exposure in the immediate environment is much lower than what one gets from holding a cell phone close to your head. The difference between a cell phone and a WiFi environment, however, is that while the cell phone is used only intermittently a WiFi environment is continuous. In addition WiFi transmitters are indoors, where people (and in this case, children) may be very close to them. There is evidence from Scandinavian studies of cell phone usage that children who use cell phones are about five times more likely to develop brain cancer than if use starts as an adult. Thus it is especially important to protect children.

To my knowledge there has not been any health investigation of individuals living or working in WiFi environments as compared to others who are not. However, because the radiation is the same as those for cell phones, there is every reason to assume that the health effects would be the same, varying only in relation to the total dose of radiation. Wired facilities do not generate any RF radiation. While there is not specific proof that WiFi increases risk of cancer, there is certainly no evidence that it is safe. I urge you to not put WiFi in any school. Children should not be put at increased risk of developing cancer.

Yours sincerely,



David O. Carpenter, M.D.
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University at Albany

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13th December 2015

PhD Mikko Ahonen, Tampere, Finland
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1. Regarding: Measurements related problems in the MCPS Wi-Fi Report

We have analysed the measurement report and would like to note the following:

- In the **Comparison-table 2.2.** the MCPS provides only average values, no peak values. In cell phone technologies (like GSM) the difference between average and peak value is 2-fold. **In Wireless local area technologies like Wi-Fi, the difference between average value and peak value is up to 100-fold** (Ferro & Potorti, 2005). Note that in the table 2.2. by the MCPS only average values are presented. Later you provide **in the chapter 7.2.2 Maximum, Instantaneous Power Density, which needs attention since these levels occasionally exceeded in your school measurements allowable EMC-levels (EN60601-1 → 3 V/m) for medical instruments** (Robinson *et al.*, 2003).

- **Almost all MCPS measurements were done in the near field of the devices under 3 wavelengths.** The wavelength for 2,4 GHz is 12,5 cm and for 5 GHz is 6 cm. That means that the near field will be <37,5 cm for 2,4 GHz and <18 cm for 5 GHz. In order to assess power density exposure in near field one needs to measure both electric and magnetic field components.

- The MCPS has not provided **information about Wi-Fi technology, namely it's beacon signal.** This signal, officially **SSID (Service Set Identifier)**, is created by the access point (AP) by sending constantly SSID 10 times in a second, at 10 Hz (Ferro and Poporti, 2005). **Mobile industry has patented technology to avoid this constant SSID sending for health reasons** (Swisscom, 2004). This SSID sending at 10 Hz is an additional risk-factor and it should be mentioned. Our brain operates in alpha, beta and gamma bands. This Wi-Fi beacon overlaps the alpha band. Low-frequency EMFs (including low-frequency pulses) have an effect on evoked potentials of the brain (Carrubba *et al.*, 2008).

- Because of the risk of this 10 Hz Beacon signal of Wi-Fi, The European Academy for Environmental Medicine has assigned very strict precautionary RF-levels for Wi-Fi (Belyaev et al., 2015). Please, pay attention to Wi-Fi RF power density peak-levels in the next picture.

RF source Max Peak/Peak Hold	Daytime exposure	Nighttime exposure	Sensitive populations ¹⁾
Radio broadcast (FM)	10,000 $\mu\text{W}/\text{m}^2$	1000 $\mu\text{W}/\text{m}^2$	100 $\mu\text{W}/\text{m}^2$
TETRA	1000 $\mu\text{W}/\text{m}^2$	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$
DVB-T	1000 $\mu\text{W}/\text{m}^2$	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$
GSM (2G) 900/1800 MHz	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$
DECT (cordless phone)	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$
UMTS (3G)	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$
LTE (4G)	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$
GPRS (2.5G) with PTCCH (8.33 Hz pulsing)	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$	0.1 $\mu\text{W}/\text{m}^2$
DAB+ (10.4 Hz pulsing)	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$	0.1 $\mu\text{W}/\text{m}^2$
Wi-Fi 2.4/5.6 GHz (10 Hz pulsing)	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$	0.1 $\mu\text{W}/\text{m}^2$

Picture. Precautionary levels for RF-radiation. For Wi-Fi less than 10 $\mu\text{W}/\text{m}^2$ (peak value), which is 0,001 $\mu\text{W}/\text{cm}^2$ (peak value). By the European Academy for Environmental Medicine (Belyaev et al., 2015, p. 356)

- We would like to draw attention to long-term exposure related health risks.

Radiofrequency radiation from Wi-Fi devices causes fertility problems as shown by several in vivo and in vitro studies (see for example Atasoy et al., 2013, Avendaño et al., 2012, Dasdag et al., 2015a, Shokri et al., 2015).

Additionally, **RF-radiation from Wi-Fi access points (AP) causes oxidative stress in cells which leads to several disorders** (see for example Nazıroğlu et al., 2012, Aynali et al., 2013, Salah et al., 2013). The overall detrimental impact of RF radiation induced oxidative stress is summarised in the review of Yakymenko et al. (2015).

2. Regarding: The IARC classification of RF-EMF as Group 2B, i.e., ‘possibly’ carcinogenic to humans and the MCPS Report’s inaccurate interpretation

The classification of radiofrequency electromagnetic fields (RF-EMF) as Group 2B, i.e., ‘possibly’ carcinogenic to humans, was made by 30 scientists from 14 countries at a meeting 2011 for the International Agency for Research on Cancer (IARC), World Health Organization (IARC 2011, Baan et al. 2012). **The working group mainly based their classification on one cohort study (Schüz et al., 2006) and five case-control studies (Muscat et al., 2000, Inskip et al., 2001, Auvinen et al., 2002, The Interphone study group, 2010, Hardell et al., 2011).**

They also reviewed more than 40 studies that assessed the carcinogenicity of RF-EMF in rodents, including seven 2-year cancer bioassays and also many studies with endpoints relevant to mechanisms of carcinogenesis, including genotoxicity, effects on immune function, gene and protein expression, cell signaling, oxidative stress, and apoptosis (Baan et al., 2011).

The referred INTERPHONE study (The Interphone study group, 2010), in the MCPS radiation report, was one of the case-control studies. **The Interphone study was a multicentre study of mobile phone use and brain tumours, including malignant tumours in the brain as glioma and benign tumours as acoustic neuroma and meningioma.** The pooled analysis included 2708 glioma cases and 2972 controls (participation rates 64% and 53%, respectively). In the Interphone study a regular user of mobile phones had an average of at least one call per week for a period of ≥ 6 months. **This very low user group was compared to several other groups of low users compared to nowadays more extensive use of mobile phones.** The highest group of users, ≥ 1640 hours was divided in three sub groups depending on how many years they had used a mobile phone. For the shortest time span on 1-4 years only 23 of the glioma cases and 8 of the controls had used their mobile phones for more than 1640 hours. If any of these 23 persons with a brain cancer or any of the 8 controls had used their mobile phones for only one year they would have used it at least in average for four and a half hours a day during a year. If they instead had talked in their mobile phones during four years it would be for an average of a little more than an hour a day. For the group of users between 5 and 9 years, 84 cases and 73 controls, the use per day would be at least between 54 minutes and 30 minutes. **For the long user group of 10 years or more, 93 cases and 73 controls, they talked in their mobile phones for 27 minutes a day or less for more than 10 years of use.**

For the main part of cases their use of mobile phones had been for a lot less than four hours a day. Today when most people use only their mobile phone and landline phones both at home and at work are becoming scarce, an amount of 4 hours or more wireless telephone use / day for salesman, telephone operators and so on is not uncommon.

In the Interphone study there was an statistical significant increased risk for a malignant brain tumour of 1.4 times (odds ratio, OR, 1.4, 95% CI 1.03-1.89) only for the highest user group of a total on more than 1640 hours.

Hardell et al. (2011) in Sweden found that **cases who had used a mobile phone for more than 1 year had an increased risk for glioma of 1.3 (OR 1.3, 95% CI 1.1-1.6).**

The risk increased with increasing time since first use and with total call time, reaching 3.2 times (OR 3.2, CI 2.0-5.1) for more than 2000 hours of use. Use of the mobile phone on the same side of the head as the tumour was associated with higher risk.

Since 2011 several other studies have been published which are strengthening the possible association between RF-EMF and cancer. Using the Bradford Hill viewpoints for evaluating strengths of evidence of the risk for brain tumours associated with use of mobile and cordless phones the classification should be upgraded to group 1 carcinogen, i.e., “the agent is carcinogenic to humans” (Hardell & Carlberg, 2013).

New case-control studies have verified Hardell's studies (Coureau et al., 2014) and up to 20 years of mobile phone use have found even higher risk for brain tumours (Hardell & Carlberg, 2015).

A newly published study has found a tumor promotion effect on mice from exposure to radiofrequency electromagnetic fields below exposure limits for humans (Lerchl *et al.*, 2015). RF-EMFs do not cause direct DNA damage. On the contrary **numerous studies have shown generation of reactive oxygen species (ROS) that can cause oxidative damage of DNA. This is a well-known mechanism in carcinogenesis for many agents.** The broad biological potential of ROS and other free radicals makes radiofrequency radiation a potentially hazardous factor for human health, not only cancer risk but also other health effects (Yakymenko *et al.*, 2015).

The IARC classification of RF-EMF as Group 2B, possibly carcinogenic to humans, doesn't only include exposure from mobile phones near the ear. **The classification includes all sources of RF-EMFs.** The exposure from mobile phone base stations, Wi-Fi access points, smart phones, laptops and tablets can be long term, sometimes around the clock both at home and at school. **This constant exposure to lower levels of exposure may be as deleterious to health as higher exposure during short time** (Fragopoulou et al., 2012, Dasdag et al., 2015b). **This risk may be accentuated for children because their probable longer use of wireless devices** (Morgan et al., 2014). **Children are also growing and have more immature cells which can be more sensible to RF-EMF** (Markova et al., 2010)

In conclusion, long term health effects from RF EMFs are still under investigation and a significant amount of troublesome scientific evidence has surfaced. By using wireless technologies at close range, long term health risks cannot be excluded. Therefore, we recommend schools to use wired technologies.

Respectfully submitted

Sincerely,



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Open letter by British medical doctors: Health and safety of Wi-Fi and mobile phones

We wish to highlight our concern over the safety of exposure to microwave radiation from wireless technology, particularly for vulnerable groups like children, pregnant women, the elderly and those with compromised health.

There is growing concern that chronic (long-term) exposure to radiofrequency/microwave radiation from wireless technologies causes damage, particularly genetic damage, cognitive damage, cancer and decreased fertility. There is now substantial evidence of a link between mobile phone use and brain cancer. This was recognised by the International Agency for Research on Cancer (IARC)'s 30-strong panel of scientists, which in 2011 classed radiofrequency radiation as "possibly carcinogenic".

Additionally, doctors are encountering a significant and growing number of people presenting with a range of acute (short-term) symptoms from wireless radiation, including headaches, palpitations, rashes, fatigue, sleep disturbance, allergies and memory and concentration problems.

International medical agencies have recognised the evidence of harm (see appended list) but these rulings may take many years to be reflected in public health policy. This controversy is a common characteristic of scientific understanding when environmental exposures are new.

New technologies and substances often come with scientific conflict, which can continue for several decades before consensus is achieved. Commercial pressures often delay the acceptance of health risks, even when scientific evidence is compelling. In the case of tobacco, asbestos, x-rays and leaded petrol, for example, it took many decades before damage was established and accepted by health agencies and, during those decades, millions of people suffered ill health and death as a result of the delay. Now, despite evidence of harm, wireless technology is being rolled out widely.

We urge health agencies and the public to act immediately to reduce exposure to radiofrequency/ microwave radiation. This is especially important for children, who are physiologically more vulnerable to this exposure, and for whom adults have a safeguarding responsibility. **Children's health should be put ahead of convenience and commercial benefits. Children should not use mobile phones except in an emergency, and WiFi should be replaced with wired alternatives in schools and other settings where children spend considerable time.**

Yours faithfully,

Dr Elizabeth Evans MA (Cantab), MBBS (Lond), DRCOG – Medical Doctor
Dr Andrew Tresidder MRCP (1989), MBBS (Lond) – Medical Doctor
Dr Erica Mallery Blythe BM - Medical Doctor
Dr Elizabeth Cullen MBBCh BAO MSc PhD – Medical Doctor
Dr Philip Michael MBBCh BAO DCH MICGP – Medical Doctor
Dr Shideh Pouria MBBS, BSc, MRCP – Medical Doctor
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Dr Jenny Goodman MA, MBChB – Ecological Physician

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Dr Elena Toma MD - Psychiatrist
Dr Joan Kinder MA, MBBChir(Cantab), MRCPCH – retired Consultant Paediatrician
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Appendix – International Rulings

1. In 2011 the **World Health Organization’s scientific panel, the International Agency for Research on Cancer (IARC)**, reviewed all the evidence on carcinogenesis (cancer-causing) and categorised electromagnetic radiation from mobile phones and Wi-Fi as **Possibly Carcinogenic (Class 2B)**.

See http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf

2. **The Council of Europe has called for member states to take measures to reduce exposure to electromagnetic fields and give preference to wired internet connections for children, particularly in schools and classrooms.**

The Parliamentary Assembly stated that “the Assembly regrets that, despite calls for the respect of the precautionary principle and despite all the recommendations, declarations and a number of statutory and legislative advances, there is still a lack of reaction to known or emerging environmental and health risks and virtually systematic delays in adopting and implementing effective preventive measures. Waiting for high levels of scientific and clinical proof before taking action to prevent well-known risks can lead to very high health and economic costs, as was the case with asbestos, leaded petrol and tobacco.”

See <http://assembly.coe.int/mainf.asp?link=/documents/adoptedtext/ta11/eres1815.htm>

3. **The BioInitiative Report**, updated in 2012 by 29 scientists, states that **biological effects are clearly established and occur at very low levels of exposure to electromagnetic fields and radiofrequency radiation** from just minutes of exposure to mobile phone masts (cell towers), WI-Fi, and wireless utility ‘smart’ meters.

See <http://www.bioinitiative.org/conclusions>

4. **The American Academy of Environmental Medicine** stated in a 2012 Position Paper that “**Multiple studies correlate RF exposure with diseases such as cancer, neurological disease, reproductive disorders, immune dysfunction, and electromagnetic hypersensitivity.**”

See http://aaemonline.org/emf_rf_position.html

6. **International Society of Doctors for the environment (ISDE) and Irish Doctors’ Environmental Association (IDEA)** state that “**there is sufficient scientific evidence to warrant more stringent controls** on the level and distribution of electromagnetic radiation [EMR]. The joint statement and recommendations are part of a call by medical and scientific experts for safe technologies in schools.”

See <http://www.env-health.org/news/members-news/article/isde-idea-statement-on>

5. **The Safe Schools Report 2012** lists statements by **other doctors and medical associations** raising concerns over children’s exposure to electromagnetic fields from Wi-Fi and other wireless technology.

See <http://wifischools.org.uk/resources/safeschools2012.pdf>



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July 10, 2009.

Open Letter to Parents, Teachers, & School Boards Regarding Wi-Fi Networks in Schools and Cell Phone Antennas near School Property

I am a scientist who does research on the health effects of electromagnetic radiation and I am becoming increasingly concerned that a growing number of schools are installing WiFi networks and are making their school grounds available for cell phone antennas.

You will be told by both the federal government (Federal Communication Commission in the US; Health Canada and Industry Canada in Canada) as well as by the Wi-Fi provider that this technology is **safe** provided that exposures to radio frequency radiation remain below federal guidelines.

This information is **outdated** and **incorrect** based on the growing number of scientific publications that are reporting adverse health and biological effects below our “short-term, thermal-based” guidelines (see www.bioinitiative.org) and the growing number of scientific and medical organizations that are asking for stricter guidelines to be enforced.

For these reasons it is irresponsible to introduce Wi-Fi microwave radiation into a school environment where young children and school employees spend hours each day.

FACT:

1. **GUIDELINES: Guidelines for microwave radiation (which is what is used in Wi-Fi) range 5 orders of magnitude in countries around the world.** The lowest guidelines are in Salzburg Austria and now in Liechtenstein. The guideline in these countries is 0.1 microW/cm². See short video (<http://videos.next-up.org/SfTv/Liechtenstein/AdoptsTheStandardOf06VmBioInitiative/09112008.html>). In Switzerland the guideline is 1 and in both Canada and the US it is 1000 microW/cm²!

Why do Canada and the US have guidelines that are so much higher than other countries? Our guidelines are based on a short-term (6-minute in Canada and 30-minute in US) heating effect. It is assumed that if this radiation does not heat your tissue it is “safe”. This is NOT correct. Effects are documented at intensities well below those that are able to heat body tissue. See attached report: *Analysis of Health and Environmental Effects of Proposed San Francisco Earthlink Wi-Fi Network* (2007). These biological effects include increased permeability of the blood brain barrier, increased calcium flux, increase in cancer and DNA breaks, induced stress proteins, and nerve damage. Exposure to this energy is associated with altered white blood cells in school children; childhood leukemia; impaired motor function, reaction time, and memory; headaches, dizziness, fatigue, weakness, and insomnia.

2. **ELECTRO-HYPER-SENSITIVITY:** A growing population is adversely affected by these electromagnetic frequencies. The illness is referred to as “electro-hyper-sensitivity” (EHS) and is recognized as a disability in Sweden. The World Health Organization defines EHS as:

“ . . . a phenomenon where individuals experience adverse health effects while using or being in the vicinity of devices emanating electric, magnetic, or electromagnetic fields (EMFs). . . EHS is a real and sometimes a debilitating problem for the affected persons, while the level of EMF in their neighborhood is no greater than is encountered in normal living environments. Their exposures are generally several orders of magnitude under the limits in internationally accepted standards. “

Health Canada acknowledges in their Safety Code 6 guideline that some people are more sensitive to this form of

energy but they have yet to address this by revising their guidelines.

Symptoms of EHS include sleep disturbance, fatigue, pain, nausea, skin disorders, problems with eyes and ears (tinnitus), dizziness, etc. It is estimated that 3% of the population are severely affected and another 35% have moderate symptoms. Prolonged exposure may be related to sensitivity and for this reason it is imperative that children's exposure to microwave radiation (Wi-Fi and mobile phones) be minimized as much as possible.

3. **CHILDREN'S SENSITIVITY:** Children are more sensitive to environmental contaminants and that includes microwave radiation. The Stewart Report (2000) recommended that children not use cell phones except for emergencies. The cell phone exposes your head to microwave radiation. A wireless computer (Wi-Fi) exposes your entire upper body and if you have the computer on your lap it exposes your reproductive organs as well. Certainly this is not desirable, especially for younger children and teenagers. For this reason we need to discourage the use of wireless technology by children, especially in elementary schools. That does not mean that students cannot go on the Internet. It simply means that access to the Internet needs to be through wires rather than through the air (wireless, Wi-Fi).
4. **REMOVAL OF WI-FI:** Most people do not want to live near either cell phone antennas or Wi-Fi antennas because of health concerns. Yet when Wi-Fi (wireless routers) are used inside buildings it is similar to the antenna being inside the building rather than outside and is potentially much worse with respect to exposure since you are closer to the source of emission.

Libraries in France are removing Wi-Fi because of concern from both the scientific community and their employees and patrons.

The Vancouver School Board (VSB) passed a resolution in January 2005 that prohibits construction of cellular antennas within 1000 feet (305 m) from school property.

Palm Beach, Florida, Los Angeles, California, and New Zealand have all prohibited cell phone base stations and antennas near schools due to safety concerns. The decision not to place cell antennas near schools is based on the likelihood that children are more susceptible to this form of radiation. **Clearly if we do not want antennas "near" schools, we certainly do not want antennas "inside" schools!** The safest route is to have wired internet access rather than wireless. While this is the more costly alternative in the short-term it is the least costly alternative in the long run if we factor in the cost of ill health of both teachers and students.

5. **ADVISORIES:** Advisories to limit cell phone use have been issued by the various countries and organizations including the UK (2000), Germany (2007), France, Russia, India, Belgium (2008) as well as the Toronto Board of Health and the Pittsburgh Cancer Institute (July 2008). While these advisories relate to cell phone use, they apply to Wi-Fi exposure as well since both use microwave radiation. If anything, Wi-Fi computers expose more of the body to this radiation than do cell phones.
6. **PRECAUTIONARY PRINCIPLE:** Even those who do not "accept" the science showing adverse biological effects of microwave exposure should recognize the need to be careful with the health of children. For this reason we have the Precautionary Principle, which states:

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capability. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost effective measures to prevent environmental degradation.

In this case "States" refers to the School Board and those who make decisions about the health of children.

The two most important environments in a child's life are the home (especially the bedroom) and the school. For this reason it is imperative that these environments remain as safe as possible. **If we are to err, please let us err on the side of caution.**

Respectfully submitted,
Dr. Magda Havas,
Associate Professor
Trent University
July 10, 2009

Shallow Minds: How the Internet and Wi-Fi in Schools Can Affect Learning

By Cindy Lee Russell, MD
VP-Community Health, Santa Clara County Medical Association

Most of us cannot live without our computers, text messaging, e-mail, and immediate access to the vast cloud of information, especially kids and teenagers who have grown up in the age of the Internet. In fact, more schools are integrating computers at younger ages, even in kindergarten. Forty-nine states are phasing out cursive handwriting altogether. What effects does it have, however, on learning, brain development, cognition, and brain health? Studies have shown some interesting ways that technology is rewiring and shaping our brain, which may not be “all good.”

A growing body of scientific evidence suggests that the Internet, with its distractions and interruptions, is turning us into scattered, superficial thinkers. What does that portend for our kids?

Multitasking and Internet Addiction

Nicholas Carr explains, in his book “The Shallows,” that we are changing the way we process information. “Dozens of studies by psychologists, neurobiologists, educators, and Web designers point to the same conclusion: When we go online, we enter an environment that promotes cursory reading, hurried and distracted thinking, and superficial learning... The Net delivers precisely the kind of sensory and cognitive stimuli—repetitive, intensive, interactive, addictive, that have been shown to result in strong and rapid alterations in brain circuits and functions.”

Researchers from Stanford, in 2009, gave a battery of cognitive tests to a group of heavy and light media Internet multitaskers. They found that the heavy multitaskers were much more easily distracted by “irrelevant environmental stimuli” and had less control over their working memory. In addition, they were much less able to focus on a particular task. Professor Clifford Nass, who led the research, stated intensive multitaskers are “suckers for irrelevancy. Everything distracts them.” (5)

“Teaching is a human experience. Technology is a distraction when we need literacy, numeracy, and critical thinking.” Paul Thomas, author and associate professor of education at Furman University

Law School Professors Ban Laptops in Classrooms

Several years ago, professors who were irritated with students surfing the Web and hiding behind laptop screens began banning the use of the Internet or laptops in the classroom. Laptops have been banned in classes at Harvard Law School, Yale, George Washington University, University of Virginia, and South Texas College of Law, to mention a few. (4)(15) A 2006 study by Carrie Fried backed up the policies, demonstrating that students who used laptops in

class spent considerable time multitasking. They more importantly found that the level of laptop use was negatively related to several measures of student learning. (3)

A 2012 survey by Elon University, the Pew Internet, and American Life Project asked over 1,000 leaders in the U.S. their thoughts about cognition in our millennial generation. They were asked to consider how the Internet and its environment are changing, for better or worse. Overall, the survey found that multitasking is the new norm and that hyper-connectivity may be leading to a lack of patience and concentration. The “always on” ethos may be encouraging a culture of expectation and instant gratification.

Brain Maturation, Learning, Memory, and Intelligence

The maturation of intelligence requires quiet, deep thought, and time. Established research findings in cognitive science leads to the conclusion that laptop use, especially with Wi-Fi access, could interfere with learning.

The hippocampus, which lies under the cortex, is intimately involved in long-term memory storage. Initial experiences are stored and stabilized in the hippocampus and then later transferred to the cortex. Removal of the hippocampus does not affect long-term memories, but prevents new memories from forming.

Learning depends on the ability to transfer information from our working memory to long-term memory and weave this into other acquired knowledge. There is a bottleneck in the passage of working memory to long-term memory. We have a limited ability as humans to capture and process information. The Internet provides too many choices and too much information at once. Excess distracting information creates “overload,” preventing long-term memorization and important information is lost. No one disagrees that we need to protect our memories. As author Nicholas Carr highlights, personal memory is not just for the individual to function, but it shapes and sustains our collective cultural memory.

Brain Drain:

Adverse Neurologic and Health Effects of Wireless Microwave Communications

A growing body of peer reviewed research is showing neurologic damage to fetal brain and other systems from Wi-Fi and other microwave wireless sources. In a prior article, “Why-Fi: Is Wireless Communication Hazardous to Your Health?” in the Sept/Oct 2010 SCCMA *Bulletin*, the full range of effects of EMF from our cell phones and wireless devices was discussed. New basic science research in the last three years is confirming these findings. Initially, the Bioinitiative report of 2007 reviewed the biological effects of low level EMF. It found that there was clear evidence of adverse effects to living systems at current environmental exposures and at doses well below the threshold of the International Commission of Non-Ionizing Radiation Protection (ICNIRP) safety guidelines. Current microwave safety limits are based solely on the heating of tissue and do not take into account research showing negative biological effects on DNA, cancer, protein synthesis, skin tissue changes, sperm motility and viability, cognitive functioning, and disruption of the blood brain barrier.

Current Research on Cognition and Wireless Communication

Fetal Radiofrequency Radiation Exposure From 800-1900 MHz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice. *Scientific Reports*. March 2012.

Aldad et al noted that neurobehavioral disorders are increasingly prevalent in children with 3%-7% of school-aged children diagnosed with attention deficit hyperactivity disorder (ADHD). The etiology is unclear, however, an association between prenatal cellular telephone use and hyperactivity in children has been postulated by others. To test this, he exposed pregnant mice to cell phone radiation throughout gestation (days 1-17), with a sham cell phone control group. He found that the exposed group had dose responsive impaired neurologic transmission in the prefrontal cortex and that the mice exposed in utero were hyperactive and had impaired memory. He concluded “that these behavioral changes were due to altered neuronal developmental programming.”(3)

Microwave Radiation Induced Oxidative Stress, Cognitive Impairment, and Inflammation in Brain of Fischer Rats. Megha. 2012.

Megha evaluated the intensity of oxidative stress, cognitive impairment, and brain inflammation in rats exposed to typical cell phone microwave radiation. They were subjected to 900 and 1,800 MHz EMF for two hours a day, for 30 days. They state, “Significant impairment in cognitive function and induction of oxidative stress in brain tissues of microwave exposed rats were observed, in comparison with sham exposed groups... Results of the present study indicated that increased oxidative stress due to microwave exposure may contribute to cognitive impairment and inflammation in brain.”

Effect of Low Level Microwave Radiation Exposure on Cognitive Function and Oxidative Stress in Rats. Deshmukh. 2013.

The author highlights the exponential increase in wireless communication devices we are exposed to. He evaluated the effects of cell phone radiation on oxidation in tissues, in addition to cognition in rats. They subjected rats to 900 MHz EMF for two hours per day, five days a week, for 30 days, with an unexposed control group. “Results showed significant impairment in cognitive function and increase in oxidative stress, as evidenced by the increase in levels of MDA (a marker of lipid peroxidation) and protein carbonyl (a marker of protein oxidation) and unaltered GSH content in blood. Thus, the study demonstrated that low level MW radiation had significant effect on cognitive function and was also capable of leading to oxidative stress.”

The Internet Can Damage Teenage Brains

A large radiologic study from China, published July 2011, looked at structural brain changes in Internet-addicted teenagers. It is estimated that 24 million teenagers are addicted to the Internet in China. The researchers found a consistent atrophy of grey matter in parts of the brain and shrinkage of the surface of the brain in those addicted to the Internet. The effects were worse the longer the addiction. In addition, the study revealed changes in white matter of the brain, which

function to transmit messages in the brain to the grey matter. They concluded these structural abnormalities were most likely associated with functional impairments in cognitive control.

“It strikes me as a terrible shame that our society requires photos of brains shrinking in order to take seriously the common-sense assumption that long hours in front of screens is not good for our children’s health. Dr Aric Sigman, Fellow of the Royal Society of Medicine

WHO Classifies EMF as a Carcinogen

In 2011, The WHO/International Agency for Research on Cancer (IARC) classified radiofrequency electromagnetic fields as “possibly carcinogenic to humans (Group 2B), based on an increased risk for glioma, a malignant type of brain cancer¹, associated with wireless phone use.”

France Bans Wi-Fi in Schools, But Replaces With Ethernet

The French National Assembly, March 2013, passed an amendment to ban Wi-Fi in their schools until it’s proven “safe for human consumption.” They instead agreed to install far safer, wired Ethernet cable connections.

The Council of Europe has called for a ban on Wi-Fi use in schools and also recommends a wired alternative.

In Austria, the Austrian Medical Society has also issued a policy statement asking for a ban of Wi-Fi in schools.

The U.K. has a useful frequently-updated website on Wi-Fi in schools, which provides much scientific research. <http://www.wifiinschools.org.uk/> Still the controversy persists.

The Cost of a Virtual World

There are a host of concerns with classroom technology, and the virtual world it creates, that have not been explored in the rush to “modernize” education and prevent our kids from becoming “computer illiterate,” despite the fact that computers are designed for ease of use. These issues range from distraction in the classroom, impairment of cognitive development and long-term memory, deficiency in learning social skills, Internet addiction, cyber bullying, access to inappropriate content, eye fatigue, and security risks to online learning networks. In addition, the sheer cost of computers and continuous upgrades is likely to break many school budgets. We have not mentioned the issue of toxic e-waste, another growing public health problem.

Common Sense

We will not get rid of the Internet or computers. We should not ignore, however, the enlarging body of science that points to real threats to public health and, especially, our children’s safety and well-being. The best approach is precautionary. Reduce the risk by reducing the microwave emissions. It is our obligation as physicians and parents to protect our children. They are the

future and our legacy.

1. Remove wireless devices (white boards and routers) in schools in favor of wired connections and fiberoptic.
2. If there is Wi-Fi, then give teachers the authority to turn it off when not in use or if they feel it is not necessary.
3. Ban cell towers near or on schools.
4. Limit screen time on computers.
5. Limit or ban cell phone use in the class.
6. Limit or ban cell phone use at home.
7. Do not allow laptops to be placed on laps.
8. Undertake independent scientific studies on Wi-Fi and computer use that look at acute and long-term health effects.
9. Train teachers how to recognize symptoms of EMF reactions.
10. Conduct meetings with parents and teachers to address this issue in each school.

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Minimize health risks from electronic devices

Published in the September 2016 NJEA Review

by Adrienne Markowitz and Eileen Senn

Desktops, laptops, tablets, eBook readers, printers, projectors, smart boards, smart TVs, cellphones, cordless phones and wireless networks (WiFi) have become ubiquitous in schools. At their best, they are powerful tools for education. At their worst, they threaten the physical and mental health of teachers, paraeducators, secretaries, librarians and other school staff members and students who spend numerous hours using the devices.

Physical health risks from electronic devices include pain and tingling from repetitive strain injuries to the hands and wrists; pain in the neck, shoulders and back; dry, burning, itchy eyes, blurred vision and headaches; altered sleep patterns and next-day fatigue from exposure to blue screen light; distracted driving; and various health problems from exposure to radiation.

Mental health risks arise from stress due to raised expectations for multitasking, productivity and proficiency with devices; dealing with malfunctioning devices; student and colleague distraction from and addiction to devices; and intrusion of devices into nonwork time.

WiFi devices emit radiation

Radio frequency (RF) electromagnetic frequency (EMF) radiation is sent and/or received by the antennae of phones, routers and other wireless devices. RF radiation is capable of causing cancer, reproductive, neurological and ocular effects. The amount of radiation exposure received depends on the amount of time exposed and distance from the source. Radiation levels fall off exponentially with distance from antennae. If you double the distance, the radiation is four times less. If you triple the distance, it is nine times less, and so on. Children and developing fetuses are particularly at risk because their bodies are still growing. People with implanted medical devices are at risk for device interference.

Hazards and solutions

The most straightforward ways to minimize health risks are to use electronic devices in moderation and to maximize your distance from them. There are also specific solutions to specific hazards listed below.

Local associations should work with their UniServ field representative to negotiate solutions that are in the control of district administrators such as providing training and ergonomic equipment and hard-wiring devices. Individuals should take steps within their control, such as:

For repetitive strain injuries

- Use voice control/speech recognition.
- Use ergonomic alternatives to traditional mice and keyboards.
- Use as many fingers as possible when typing and both thumbs when texting.

For neck, shoulder and back pain

- Ensure an ergonomic workstation.
- When using a hand-held device, support it and the forearms.
- Avoid bending the head down or jutting it forward.
- Take frequent, short breaks from the device.
- Ensure good posture and change positions frequently.
- Stand and do stretching exercises.

For eye pain, blurred vision and headaches

- Use sufficient, but not excessive, lighting.
- Use assistive technology built into Apple, Android and Windows devices.
- Enlarge and darken the cursor and pointer.
- Enlarge the font; magnify the text.
- Use text-to-speech instead of reading.
- Use special computer glasses.
- Relax the eyes on a minibreak.

For altered sleep patterns and next-day fatigue

- Stop using devices at least one hour before bedtime.

For distracted driving

- Use hands-free devices, preferably speakerphones.
- Pull over and park.
- Let someone else drive.

For radiation exposure

- Keep devices away from the body and bedroom.
- Carry phones in briefcases, etc., not on the body.
- Put devices on desks, not laps.
- Hard wire all devices that connect to the internet.
- Hard wire all fixed devices such as printers, projectors and boards.
- Use hard-wired phones instead of cell or cordless phones.
- Text rather than call.
- Keep conversations short or talk in person.
- Put devices in airplane mode, which suspends EMF transmission by the device, thereby disabling Bluetooth, GPS, phone calls, and WiFi.
- Use speaker phone or ear buds instead of holding the phone next your head.
- Take off Bluetooth devices when not using them.

For stress

- Training in device use, assistive technology.
- Easy access to user manuals.
- Easily available technical support.

Cell phones and cancer

The National Toxicology Program (NTP) is conducting the largest set of laboratory rodent studies to date on cellphone RF radiation. The studies cost \$25 million and are designed to mimic human exposure. They are based on the cellphone

frequencies and modulations currently in use in the United States. The NTP studies are designed to look at effects in all parts of the body.

On May 27, 2016, NTP released a report with partial results of the studies. They found increased occurrence of rare brain tumors called gliomas and increases in nerve tumors called schwannoma of the heart in male rats. The released results are partial because more rat studies and all of the mouse studies will be forthcoming by 2017. The cells that became cancerous in the rats were the same types of cells as those that have been reported to develop into tumors in human cellphone users.

The EMF produced by cellphones was classified as possibly carcinogenic to humans by the World Health Organization in 2011. They found that long-term use of a cell phone might lead to two different types of tumors, gliomas and acoustic neuroma, a tumor of the auditory nerve.

For more information

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Resolution 1815 (2011)¹

Final version

The potential dangers of electromagnetic fields and their effect on the environment

Parliamentary Assembly

1. The Parliamentary Assembly has repeatedly stressed the importance of states' commitment to preserving the environment and environmental health, as set out in many charters, conventions, declarations and protocols since the United Nations Conference on the Human Environment and the Stockholm Declaration (Stockholm, 1972). The Assembly refers to its past work in this field, namely [Recommendation 1863 \(2009\)](#) on environment and health: better prevention of environment-related health hazards, [Recommendation 1947 \(2010\)](#) on noise and light pollution, and more generally, [Recommendation 1885 \(2009\)](#) on drafting an additional protocol to the European Convention on Human Rights concerning the right to a healthy environment and [Recommendation 1430 \(1999\)](#) on access to information, public participation in environmental decision-making and access to justice – implementation of the Århus Convention.
2. The potential health effects of the very low frequency of electromagnetic fields surrounding power lines and electrical devices are the subject of ongoing research and a significant amount of public debate. According to the World Health Organization, electromagnetic fields of all frequencies represent one of the most common and fastest growing environmental influences, about which anxiety and speculation are spreading. All populations are now exposed in varying degrees to electromagnetic fields, the levels of which will continue to increase as technology advances.
3. Mobile telephony has become commonplace around the world. This wireless technology relies upon an extensive network of fixed antennae, or base stations, relaying information with radio-frequency signals. Over 1.4 million base stations exist worldwide and the number is increasing significantly with the introduction of third generation technology. Other wireless networks that allow high-speed Internet access and services, such as wireless local area networks, are also increasingly common in homes, offices and many public areas (airports, schools, residential and urban areas). As the number of base stations and local wireless networks increases, so does the radio-frequency exposure of the population.
4. While electrical and electromagnetic fields in certain frequency bands have wholly beneficial effects which are applied in medicine, other non-ionising frequencies, whether from extremely low frequencies, power lines or certain high frequency waves used in the fields of radar, telecommunications and mobile telephony, appear to have more or less potentially harmful, non-thermal, biological effects on plants, insects and animals as well as the human body, even when exposed to levels that are below the official threshold values.
5. As regards standards or threshold values for emissions of electromagnetic fields of all types and frequencies, the Assembly strongly recommends that the ALARA (as low as reasonably achievable) principle is applied, covering both the so-called thermal effects and the athermal or biological effects of electromagnetic emissions or radiation. Moreover, the precautionary principle should be applied when scientific evaluation does not allow the risk to be determined with sufficient certainty. Given the context of growing exposure of the population, in particular that of vulnerable groups such as young people and children, there could be extremely high human and economic costs if early warnings are neglected.

1. Text adopted by the Standing Committee, acting on behalf of the Assembly, on 27 May 2011 (see [Doc. 12608](#), report of the Committee on the Environment, Agriculture and Local and Regional Affairs, rapporteur: Mr Huss).



6. The Assembly regrets that, despite calls for the respect of the precautionary principle and despite all the recommendations, declarations and a number of statutory and legislative advances, there is still a lack of reaction to known or emerging environmental and health risks and virtually systematic delays in adopting and implementing effective preventive measures. Waiting for high levels of scientific and clinical proof before taking action to prevent well-known risks can lead to very high health and economic costs, as was the case with asbestos, leaded petrol and tobacco.

7. Moreover, the Assembly notes that the problem of electromagnetic fields or waves and their potential consequences for the environment and health has clear parallels with other current issues, such as the licensing of medication, chemicals, pesticides, heavy metals or genetically modified organisms. It therefore highlights that the issue of independence and credibility of scientific expertise is crucial to accomplish a transparent and balanced assessment of potential negative impacts on the environment and human health.

8. In light of the above considerations, the Assembly recommends that the member states of the Council of Europe:

8.1. in general terms:

8.1.1. take all reasonable measures to reduce exposure to electromagnetic fields, especially to radio frequencies from mobile phones, and particularly the exposure to children and young people who seem to be most at risk from head tumours;

8.1.2. reconsider the scientific basis for the present standards on exposure to electromagnetic fields set by the International Commission on Non-Ionising Radiation Protection, which have serious limitations, and apply ALARA principles, covering both thermal effects and the athermic or biological effects of electromagnetic emissions or radiation;

8.1.3. put in place information and awareness-raising campaigns on the risks of potentially harmful long-term biological effects on the environment and on human health, especially targeting children, teenagers and young people of reproductive age;

8.1.4. pay particular attention to "electrosensitive" people who suffer from a syndrome of intolerance to electromagnetic fields and introduce special measures to protect them, including the creation of wave-free areas not covered by the wireless network;

8.1.5. in order to reduce costs, save energy, and protect the environment and human health, step up research on new types of antenna, mobile phone and DECT-type device, and encourage research to develop telecommunication based on other technologies which are just as efficient but whose effects are less negative on the environment and health;

8.2. concerning the private use of mobile phones, DECT wireless phones, WiFi, WLAN and WIMAX for computers and other wireless devices such as baby monitors:

8.2.1. set preventive thresholds for levels of long-term exposure to microwaves in all indoor areas, in accordance with the precautionary principle, not exceeding 0.6 volts per metre, and in the medium term to reduce it to 0.2 volts per metre;

8.2.2. undertake appropriate risk-assessment procedures for all new types of device prior to licensing;

8.2.3. introduce clear labelling indicating the presence of microwaves or electromagnetic fields, the transmitting power or the specific absorption rate (SAR) of the device and any health risks connected with its use;

8.2.4. raise awareness on potential health risks of DECT wireless telephones, baby monitors and other domestic appliances which emit continuous pulse waves, if all electrical equipment is left permanently on standby, and recommend the use of wired, fixed telephones at home or, failing that, models which do not permanently emit pulse waves;

8.3. concerning the protection of children:

8.3.1. develop within different ministries (education, environment and health) targeted information campaigns aimed at teachers, parents and children to alert them to the specific risks of early, ill-considered and prolonged use of mobiles and other devices emitting microwaves;

8.3.2. for children in general, and particularly in schools and classrooms, give preference to wired Internet connections, and strictly regulate the use of mobile phones by schoolchildren on school premises;

- 8.4. concerning the planning of electric power lines and relay antenna base stations:
 - 8.4.1. introduce town planning measures to keep high-voltage power lines and other electric installations at a safe distance from dwellings;
 - 8.4.2. apply strict safety standards for the health impact of electrical systems in new dwellings;
 - 8.4.3. reduce threshold values for relay antennae in accordance with the ALARA principle and install systems for comprehensive and continuous monitoring of all antennae;
 - 8.4.4. determine the sites of any new GSM, UMTS, WiFi or WIMAX antennae not solely according to the operators' interests but in consultation with local and regional government authorities, local residents and associations of concerned citizens;
- 8.5. concerning risk assessment and precautions:
 - 8.5.1. make risk assessment more prevention oriented;
 - 8.5.2. improve risk-assessment standards and quality by creating a standard risk scale, making the indication of the risk level mandatory, commissioning several risk hypotheses to be studied and considering compatibility with real-life conditions;
 - 8.5.3. pay heed to and protect "early warning" scientists;
 - 8.5.4. formulate a human-rights-oriented definition of the precautionary and ALARA principles;
 - 8.5.5. increase public funding of independent research, in particular through grants from industry and taxation of products that are the subject of public research studies to evaluate health risks;
 - 8.5.6. create independent commissions for the allocation of public funds;
 - 8.5.7. make the transparency of lobby groups mandatory;
 - 8.5.8. promote pluralist and contradictory debates between all stakeholders, including civil society (Århus Convention).

The Health Argument against Cell Phones and Cell Towers

The biomedical evidence showing that the radiofrequency radiation emitted by cell phones and cell towers is harmful to health continues to grow. This document summarizes the health argument against cellular technology, whatever the benefits of that technology may be. You may wish to inform yourself about these arguments for any of several reasons:

- You use a cell phone.
- You encourage, or do not discourage, the use of cell phones by family members.
- You live in, or are contemplating moving into, a community close to a cell tower.
- Your school, college, fire station, or police station is considering permitting the installation of a cell tower on its property.
- Your community is considering permitting the installation of cellular repeaters, small-cell towers, or even full cell towers within its jurisdiction.

Below, I introduce myself, provide evidence of the harmfulness of cellular radiation, and show that U.S. Government is not protecting us from harm and is unlikely to do so in the near future. That means that we must protect ourselves and our families at the individual and the community levels while working toward protective action by governments at the local, state, and Federal levels.

Who am I?

I am a retired U.S. Government career scientist (Ph.D., Applied Physics, Harvard University, 1975). During my Government career, I worked for the Executive Office of the President of the United States, the National Science Foundation, and the National Institute of Standards and Technology. For those organizations, respectively, I addressed Federal research and development program evaluation, energy policy research, and measurement development in support of the electronics and electrical-equipment industries and the biomedical research community. I currently interact with other scientists and with physicians around the world on the impact of electromagnetic fields on human health.

Evidence of harm

I present below key evidence, and associated references, that the exposure of humans to radiofrequency radiation, and specifically cellular radiation, is harmful to health.

In 2016, the National Toxicology Program, at the National Institutes of Health, linked cellular radiation to brain and heart tumors.

The National Toxicology Program (NTP), at the National Institutes of Health (NIH), just published the “Partial Findings” of a \$25 million multi-year study of the impact of cellular radiation on health. The U.S. Food and Drug Administration “nominated” this NTP study. The NTP indicated that this is the largest and most complex study ever conducted by the NTP.

¹ Ronald M. Powell, Ph.D., USA, email ronpowell@verizon.net, web site <https://www.scribd.com/document/291507610/>.

The NTP study exposed each of six separate groups of male rats to one of the six possible combinations of three different levels of cellular radiation and two different modulation formats. The modulation format is the method used to impress information on the cellular signal. A separate seventh group of male rats was used as a “control”, that is, for comparison, and was protected from exposure to any cellular radiation.

The NTP study found a “likely” causal relationship between exposure to cellular radiation and the occurrence of malignant brain cancer (glioma) and malignant nerve tumors (schwannomas) of the heart in the male rats:

The rates of occurrence of brain glioma in the male rats ranged from 0 to 3.3 percent for the six groups exposed to radiation. The mean rate of occurrence was 2.0 percent across all six groups.²

The rates of occurrence of heart schwannoma in the male rats ranged from 1.1 to 6.6 percent for the six groups exposed to radiation. The mean rate of occurrence was 3.5 percent across all six groups.³

The seventh group of male rats, which was used as a control and which was protected from exposure to any cellular radiation, experienced no instances of brain glioma or heart schwannoma.

The NTP considered its findings so important to public health that it issued the “Partial Findings” (May 2016) prior to completing the full study. The NTP then presented those findings at an international conference (BioEM2016, June 2016) attended by 300 scientists from 41 countries. The NTP characterized the motivation for the early release of the “Partial Findings” this way:

“Given the widespread global usage of mobile communications among users of all ages, even a very small increase in the incidence of disease resulting from exposure to RFR [radiofrequency radiation] could have broad implications for public health. There is a high level of public and media interest regarding the safety of cell phone RFR and the specific results of these NTP studies.”

The NTP promised further findings from its study for publication through 2017. Included in those further findings will be test results on mice. You can learn more about this study from the following references:

Reference: NTP’s brief description of its study. National Toxicology Program: Cell Phones.
(<http://ntp.niehs.nih.gov/results/areas/cellphones/index.html>)

Reference: NTP’s published “Partial Findings” of the study. Michael Wyde, Mark Cesta, Chad Blystone, Susan Elmore, Paul Foster, Michelle Hooth, Grace Kissling, David Malarkey, Robert Sills, Matthew Stout, Nigel Walker, Kristine Witt, Mary Wolfe, and John Bucher, Report of Partial Findings from the National Toxicology Program Carcinogenesis Studies of Cell Phone Radiofrequency Radiation in Hsd: Sprague Dawley® SD rats (Whole Body Exposure), posted June 23, 2016.
(<http://biorxiv.org/content/biorxiv/early/2016/06/23/055699.full.pdf>)

Reference: Informative discussion of the NTP study. Environmental Health Trust, Frequently Asked Questions about the U.S. National Toxicology Program Radiofrequency Rodent Carcinogenicity Research Study.
(<http://ehtrust.org/science/facts-national-toxicology-program-cellphone-rat-cancer-study>)

² In the “Partial Findings” reference cited above, the mean (average) rate of occurrence for malignant glioma in male rats was determined from Table 1 on page 13 as follows: $(3 + 3 + 2 + 0 + 0 + 3)/(90 + 90 + 90 + 90 + 90 + 90) = 2.0$ percent.

³ In the “Partial Findings” reference cited above, the mean (average) rate of occurrence for malignant heart schwannoma in male rats was determined from Table 3 on page 15 as follows: $(2 + 1 + 5 + 2 + 3 + 6)/(90 + 90 + 90 + 90 + 90 + 90) = 3.5$ percent.

Reference: Announcement of the BioEM2016 presentation. Results of NIEHS' National Toxicology Program GSM/CDMA phone radiation study to be presented at BioEM2016 Meeting in Ghent, 05 June 2016 — 10 June 2016 Ghent University, Belgium.

(<http://www.alphagalileo.org/ViewItem.aspx?ItemId=164837&CultureCode=en>)

Reference: Viewgraphs presented by Michael Wyde, Ph.D., NTP study scientist, at BioEM2016 Meeting, Ghent, Belgium, June 8, 2016. NTP Toxicology and Carcinogenicity Studies of Cell Phone Radiofrequency Radiation.

(http://ntp.niehs.nih.gov/ntp/research/areas/cellphone/slides_bioem_wyde.pdf)

The NTP study reinforces the classification of radiofrequency radiation, including cellular radiation, as a possible human carcinogen, made by the International Agency for Research on Cancer of the World Health Organization in 2011.

In its "Partial Findings" the NTP noted that its study reinforces a decision made by the International Agency for Research on Cancer (IARC) of the World Health Organization (WHO) in 2011. That decision classified radiofrequency radiation, including specifically cellular radiation, as a Group 2B carcinogen (possible carcinogen for humans). This classification was based on the increased risk of malignant brain cancer (glioma) and acoustic neuroma (a benign tumor of the auditory nerve), which is a form of schwannoma (vestibular schwannoma).⁴

Reference: Announcement of the IARC classification. International Agency for Research on Cancer, IARC Classifies Radiofrequency Electromagnetic Fields as Possibly Carcinogenic To Humans, Press Release No. 208, 31 May 2011.

(http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf)

Reference: Full report on the IARC classification. IARC Monographs: Non-Ionizing Radiation, Part 2: Radiofrequency Electromagnetic Fields, Volume 102, 2013.

(<http://monographs.iarc.fr/ENG/Monographs/vol102/mono102.pdf>)

The findings of the NTP study, in combination with the findings of other studies conducted since 2011, have greatly increased the likelihood that the IARC will raise its classification of radiofrequency radiation to Group 2A (probable carcinogen for humans) or even to Group 1 (known carcinogen for humans) in the near future.

In 2015, hundreds of international scientists appealed to the United Nations and the World Health Organization to warn the public about the health risks caused by electromagnetic fields (EMF), including radiofrequency radiation and, specifically, cellular radiation.

As of January 29, 2017, 224 scientists from 41 nations have signed an international appeal first submitted to the United Nations and to the World Health Organization in May 2015. These scientists seek improved protection of the public from harm caused by the radiation produced by many wireless sources, including "cellular and cordless phones and their base stations, Wi-Fi, broadcast antennas, smart meters, and baby monitors" among others. Together, these scientists "have published more than 2000 research papers and studies on EMF." They state the following:

⁴ The Mayo Clinic describes acoustic neuroma here: <http://www.mayoclinic.org/diseases-conditions/acoustic-neuroma/basics/definition/CON-20023851>.

“Numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines. Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being in humans. Damage goes well beyond the human race, as there is growing evidence of harmful effects to both plant and animal life.”

Reference: Welcome to EMFscientist.org.
(<https://www.emfscientist.org>)

Reference: International EMF Scientist Appeal: Scientists call for Protection from Non-ionizing Electromagnetic Field Exposure, May 15, 2015 (updated October 10, 2016).
(<https://www.emfscientist.org/index.php/emf-scientist-appeal>)

Reference: International Scientists Petition U.N. to Protect Humans and Wildlife from Electromagnetic Fields and Wireless Technology.
(https://www.emfscientist.org/images/docs/International_EMF_Scientist_Appeal_Description.pdf)

In 2012, the BioInitiative Working Group published the most comprehensive of the recent analyses of the international biomedical research, showing a multitude of biological effects from exposure to radiofrequency radiation, including cellular radiation, at levels below the current exposure guidelines set by the Federal Communications Commission (FCC).

The health risks posed by the expanding use of radiofrequency radiation in wireless devices are not limited to cancer, as devastating as that consequence is. The broad range of health effects was extensively reviewed in the BioInitiative Report 2012. This 1479-page review considered about 1800 peer-reviewed biomedical research publications, most issued in the previous five years. The BioInitiative Report 2012 was prepared by an international body of 29 experts, heavy in Ph.D.s and M.D.s, from 10 countries, including the USA which contributed the greatest number of experts (10). The report concluded the following:

“The continued rollout of wireless technologies and devices puts global public health at risk from unrestricted wireless commerce unless new, and far lower exposure limits and strong precautionary warnings for their use are implemented.”

Reference: BioInitiative Working Group, Cindy Sage, M.A. and David O. Carpenter, M.D., Editors, BioInitiative Report: A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Radiation, December 31, 2012.
(<http://www.bioinitiative.org>)

The BioInitiative Report 2012 documented, in its “RF Color Charts”, examples of eight categories of biological effects that occurred at levels below the current exposure guidelines set by the FCC:

- stress proteins, heat shock proteins, and disrupted immune function
- reproduction and fertility effects
- oxidative damage, reactive ion species (ROS), DNA damage, and DNA repair failure
- disrupted calcium metabolism
- brain tumors and blood-brain barrier
- cancer (other than brain) and cell proliferation

- sleep, neuron firing rate, electroencephalogram (EEG), memory, learning, and behavior
- cardiac, heart muscle, blood-pressure, and vascular effects.

These biological effects were attributed to “Radiofrequency Radiation at Low Intensity Exposure” from “cell towers, Wi-Fi, wireless laptops, and smart meters”.

Reference: See the “RF Color Charts”, accessed from the left column of the web page below.
<http://www.bioinitiative.org>

The U.S. Government is not protecting us.

The radiation exposure guidelines of the FCC do not protect us because they are outdated and based on a false assumption.

The current radiation exposure guidelines of the FCC were adopted in 1996, 20 years ago. Those guidelines are based primarily on an analysis by the National Council on Radiation Protection and Measurements (NCRP) which was published in 1986, 30 years ago. That was many years before the emergence of nearly all of the digital wireless devices in use today.

“The FCC-adopted limits for Maximum Permissible Exposure (MPE) are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP) in 'Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,' NCRP Report No. 86, Sections 17.4.1, 17.4.1.1, 17.4.2 and 17.4.3. Copyright NCRP, 1986, Bethesda, Maryland 20814....”

Reference: Federal Communications Commission, Office of Engineering & Technology, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, OET Bulletin 65, Edition 97-01 (August 1997). See the last paragraph on page 64.
http://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65/oet65.pdf

Those exposure guidelines have not been substantially changed since that analysis in 1986. They are based on the *thermal assumption* that the only harm that radiofrequency radiation can cause is due to tissue heating. This thermal assumption has been thoroughly disproved since, as biological effects have been found to occur at levels of radiation below, and even far below, those that cause significant tissue heating. Such lower levels are commonly referred to as *nonthermal* levels. The result is that many authorities now consider the FCC’s current exposure guidelines as entirely outdated and much too high (that is, much too permissive) to protect the public.

The evidence disproving the thermal assumption is based on the broadened understanding of the biological effects of radiofrequency radiation made possible by thousands of peer-reviewed papers published by international biomedical scientists since 1986. The BioInitiative Report 2012 is the most recent comprehensive review of that research and provides many examples of bioeffects occurring at nonthermal radiation levels, as described above. Further, the new study by the National Toxicology Program, also described above, added to the evidence disproving the thermal assumption. That study exposed rats to levels of radiation below those that cause significant heating, and both above and below the FCC’s current exposure guidelines as well. Yet, even below the FCC’s current exposure guidelines, the male rats still developed malignant brain cancer (glioma) and malignant tumors (schwannomas) of the nerves of the heart.

The shortcomings of the FCC's exposure guidelines are described in detail in the following reference:

Reference: Outdated FCC "Safety" Standards: The Five Fallacies of the Electromagnetic Radiation Exposure Limits.

(<http://ehtrust.org/policy/fcc-safety-standards/>)

The FCC is not a credible source for exposure guidelines because it lacks health expertise and because it is too heavily influenced by the wireless industries that it is supposed to regulate.

The FCC lacks the health expertise required for developing health-related radiation exposure guidelines. Further, the FCC seems more interested in assuring compatibility among electronic systems than in assuring the compatibility of electronic systems with human, animal, and plant life. Since the exposure guidelines relate to health, it would make more sense for them to be developed by an agency with health expertise, such as the Environmental Protection Agency (EPA).

In addition, the FCC lacks the impartiality required to be a source of credible guidelines. The FCC is too heavily influenced by the wireless industries that the FCC is supposed to regulate. The FCC has acted in partnership with the wireless industries by permitting wireless radiation levels far higher than the biomedical research literature indicates are necessary to protect human health. The success of the wireless industries in capturing the FCC, the committees in the U.S. Congress that oversee the FCC, and the Executive Branch is detailed in a recent monograph from the Center for Ethics at Harvard University.

Reference: Norm Alster, Captured Agency: How the Federal Communications Commission is Dominated by the Industries It Presumably Regulates (2015).

(<http://ethics.harvard.edu/news/new-e-books-edmond-j-safra-research-lab>)

As an example of that capture, President Obama, in 2013, appointed Thomas Wheeler, as the Chairman of the FCC. At that time, Mr. Wheeler was the head of the CTIA – The Wireless Association, which is the major lobbying organization for the wireless industries. This is the infamous "revolving door".

The FCC's decision to fast-track Fifth Generation (5G) cellular technology without prior study of its health impact demonstrates the FCC's disinterest in the public health.

On July 14, 2016, the FCC adopted new rules that would promote fast-tracking the expansion of cellular service to new and higher frequencies as part of the Fifth Generation (5G) of cellular technology. This decision will open selected frequency bands above 24 gigahertz (GHz) and up to 71 GHz. At the same time, the FCC has requested comment on opening even higher frequencies, possibly above 95 GHz.

Reference: FCC Takes Steps to Facilitate Mobile Broadband and Next Generation Wireless Technologies in Spectrum above 24 GHz: New rules will enable rapid development and deployment of next generation 5G technologies and services.

(http://transition.fcc.gov/Daily_Releases/Daily_Business/2016/db0714/DOC-340301A1.pdf)

Reference: Fact Sheet: Spectrum Frontiers Rules Identify, Open Up Vast Amounts of New High-Band Spectrum for Next Generation (5G) Wireless Broadband.

(http://transition.fcc.gov/Daily_Releases/Daily_Business/2016/db0714/DOC-340310A1.pdf)

All five commissioners of the FCC, including Chairman Thomas Wheeler, approved this expedited move to 5G. No commissioner called for evaluating the health impact before proceeding with 5G, despite the recent findings of the National Toxicology Program at NIH that cellular radiation likely causes tumors. Nor did even one commissioner express any interest in, or concern about, the impact of this new technology on public health. Rather, the FCC's emphasis was on the billions of dollars to be made by proceeding to implement 5G as rapidly as possible, with a minimum of regulatory interference, to assure an international competitive position.

In contrast to the FCC's disinterest in the impact of 5G on the public health, extensive written comments from individual members of the public and from many interested organizations raised a host of health concerns that were totally ignored in the FCC's presentations.

Reference: July 2016 Open Commission Meeting addressing "Spectrum Frontiers" and "Advancing Technology Transitions".

(<https://www.fcc.gov/news-events/events/2016/07/july-2016-open-commission-meeting>)

Reference: The FCC Approves 5G Millimeter Wave Spectrum Frontiers. Includes excerpts from selected comments provided to the FCC by individuals and organizations that expressed concern about the health impact of the FCC's plan for 5G.

(<http://ehtrust.org/policy/fcc-approves-5g-millimeter-wave-spectrum-frontiers/>)

Reference: Comments on FCC Docket 14-177, Spectrum Bands above 24 GHz. All of the comments submitted to the FCC about the key docket leading to the implementation of 5G.

(https://www.fcc.gov/ecfs/search/filings?proceedings_name=14-177&sort=date_disseminated,DESC)

U.S. Government agencies, and U.S. medical organizations, have disputed the validity of the FCC's exposure guidelines.

U.S. Government agencies, as well as U.S. medical organizations, have disputed the validity of the FCC's thermal exposure guidelines, maintaining that they are outdated and need to be updated to provide adequate protection of human beings, including children and seniors as well as other vulnerable groups.

U.S. Environmental Protection Agency

The Environmental Protection Agency (EPA) would be a better agency than the FCC to entrust with setting radiofrequency radiation exposure guidelines because the EPA has both health expertise and environmental responsibilities. The EPA is often cited by the FCC, and by the wireless industries, as one of the agencies that the FCC has *consulted* about the FCC's exposure guidelines, as if to increase the credibility of those guidelines. However, the fact that the EPA has *explicitly disputed* the validity of those guidelines is consistently omitted from those FCC citations.

Specifically, in 2002, the EPA addressed the limitations of the thermal exposure guidelines of the FCC, and the similar guidelines of private organizations, including the Institute of Electrical and Electronics Engineers and the International Commission on Non-Ionizing Radiation Protection:

"The FCC's current exposure guidelines, as well as those of the Institute of Electrical and Electronics Engineers (IEEE) and the International Commission on Non-ionizing Radiation Protection, are thermally based, and do not apply to chronic, nonthermal exposure situations.... The FCC's exposure guideline is

considered protective of effects arising from a thermal mechanism but not from all possible mechanisms. Therefore, the generalization by many that the guidelines protect human beings from harm by any or all mechanisms is not justified.”

“Federal health and safety agencies have not yet developed policies concerning possible risk from long-term, nonthermal exposures. When developing exposure standards for other physical agents such as toxic substances, health risk uncertainties, with emphasis given to sensitive populations, are often considered. Incorporating information on exposure scenarios involving repeated short duration/nonthermal exposures that may continue over very long periods of time (years), with an exposed population that includes children, the elderly, and people with various debilitating physical and medical conditions, could be beneficial in delineating appropriate protective exposure guidelines.”

Reference: Letters from Frank Marcinowski, Director, Radiation Protection Division, EPA, and Norbert Hankin, Center for Science and Risk Assessment, Radiation Protection Division, EPA, to Janet Newton, President, the EMR Network, with copies to the FCC and the IEEE, dated July 16, 2002.

(http://www.emrpolicy.org/litigation/case_law/docs/noi_epa_response.pdf)

In summary, the EPA makes the following points: (1) the FCC’s thermal exposure guidelines do *not* protect against all harm, only the harm caused by too much heating; (2) the FCC’s thermal exposure guidelines do *not* apply to “chronic, nonthermal exposure”, which is the type of exposure generated by cell towers and many other wireless devices; and (3) when new FCC guidelines are developed for chronic nonthermal exposures, they must accommodate “children, the elderly, and people with various debilitating physical and medical conditions” because those groups are not accommodated now.

U.S. Food and Drug Administration

The Food and Drug Administration (FDA) is also often cited by the FCC, and by the wireless industries, as one of the agencies that the FCC has consulted about exposure guidelines. But the FDA is the agency that “nominated” the NTP study of the possible health effects of cellular radiation, in part because of the FDA’s uncertainty about the validity of the FCC’s exposure guidelines:

“Currently cellular phones and other wireless communication devices are required to meet the radio frequency radiation (RFR) exposure guidelines of the Federal Communications Commission (FCC), which were most recently revised in August 1996. The existing exposure guidelines are based on protection from acute injury from thermal effects of RFR exposure, and may not be protective against any non-thermal effects of chronic exposures.”

Reference: Nominations from FDA’s Center for [for] Device[s] and Radiological Health, Radio Frequency Radiation Emissions of Wireless Communication Devices (CDRH), Executive Summary, as attached to transmittal letter from William T. Allaben, Ph.D., FDA Liaison, to Dr. Errol Zeiger, Coordinator, Chemical Nomination and Selection, National Toxicology Program, May 19, 1999,⁵ (http://ntp.niehs.nih.gov/ntp/htdocs/chem_background/exsumpdf/wireless051999_508.pdf)

The FDA’s wisdom in nominating the NTP study was well justified by the NTP’s publication of the “Partial Findings” described above. Those findings demonstrated both that the FCC’s exposure guidelines are not protective and that the thermal assumption on which those guidelines are based is invalid.

⁵ This date and the referenced URL were changed when this superior reference was posted, at my request, by the NTP/NIEHS/NIH.

U.S. Department of the Interior

In 2014 the Department of the Interior (Fish and Wildlife Service) also addressed the limitations of the FCC's thermal exposure guidelines. The Department of the Interior was motivated by the multiple adverse effects of electromagnetic radiation on the health, and the life, of birds, particularly in connection with cell towers. The Department of the Interior stated the following:

"However, the electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today."

Reference: Letter from Willie R. Taylor, Director, Office of Environmental Policy and Compliance, Office of the Secretary, United States Department of the Interior, to Mr. Eli Veenendaal, National Telecommunications and Information Administration, U.S. Department of Commerce, dated February 7, 2014.

https://www.ntia.doc.gov/files/ntia/us_doi_comments.pdf

American Academy of Environmental Medicine

The American Academy of Environmental Medicine (AAEM), which trains physicians in preparation for Board Certification in Environmental Medicine, states the following:

"The AAEM strongly supports the use of wired Internet connections, and encourages avoidance of radiofrequency such as from WiFi, cellular and mobile phones and towers, and 'smart meters'."

"The peer reviewed, scientific literature demonstrates the correlation between RF [radiofrequency] exposure and neurological, cardiac, and pulmonary disease as well as reproductive and developmental disorders, immune dysfunction, cancer and other health conditions. The evidence is irrefutable."

"To install WiFi in schools plus public spaces risks a widespread public health hazard that the medical system is not yet prepared to address."

Reference: American Academy of Environmental Medicine, Wireless Radiofrequency Radiation in Schools, November 14, 2013.

<http://www.aeonline.org/pdf/WiredSchools.pdf>

American Academy of Pediatrics

The American Academy of Pediatrics (AAP), whose 60,000 doctors care for our children, supports the development of more restrictive standards for radiofrequency radiation exposure in order to better protect the public, particularly the children. In a letter to the Federal Communications Commission (FCC) and the Food and Drug Administration (FDA), dated August 29, 2013, the AAP states the following:

"Children are not little adults and are disproportionately impacted by all environmental exposures, including cell phone radiation. Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children. It is essential that any new standard for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded throughout their lifetimes."

Reference: American Academy of Pediatrics, letter dated August 29, 2013 addressed to The Honorable Mignon L. Clyburn, Acting Commissioner, Federal Communications Commission, and The Honorable Dr. Margaret A. Hamburg, Commissioner, U.S. Food and Drug Administration.

(<http://apps.fcc.gov/ecfs/document/view?id=7520941318>)

After reviewing the “Partial Findings” from the new study by the National Toxicology Program at the National Institutes of Health, described above, the American Academy of Pediatrics cautioned parents about the use of cell phones by their children:

“In light of the findings, the Academy continues to reinforce its recommendation that parents should limit use of cell phones by children and teens.”

Reference: American Academy of Pediatrics, AAP responds to study showing link between cell phone radiation, tumors in rats, May 27, 2016.

(<http://www.aappublications.org/news/2016/05/27/Cancer052716>)

The Telecommunications Act of 1996, in combination with the FCC’s exposure guidelines, empowers the wireless industries to mandate the exposure of the public to levels of radiofrequency radiation already found harmful to health.

The Telecommunications Act of 1996 bars state and local governments from objecting to the placement of cell towers on environmental/health grounds unless the FCC’s exposure guidelines would be exceeded. Specifically, the Act states the following:

“No State or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's [FCC’s] regulations concerning such emissions.”

Reference: Telecommunications Act of 1996, Section 704 Facilities Siting; Radio Frequency Emission Standards, page 117.

(<http://transition.fcc.gov/Reports/tcom1996.pdf>)

This Act, in combination with the FCC’s permissive exposure guidelines, strips state and local governments of the right to protect their own residents from levels of radiofrequency radiation already shown to be harmful to health. In effect, this Act transfers to the wireless industries the right to **mandate** the exposure of the public, including those most vulnerable to harm, to radiofrequency radiation without the need for further governmental action. State and local governments can still resist, but to do so they must confront this Act which is designed to frustrate their success. Even so, some governments do heroically resist and some do succeed.

Protecting ourselves and our families

We can act on our own to protect ourselves and our families, but only partially.

Instead of increasing our exposure to cellular radiation, and to the radiation from other digital wireless

devices, we can decrease our exposure and improve our chances for good health. Desirable steps in this direction include the following:

- Reduce or stop the use of cell phones. Reserve them for emergencies or other essential uses.
- Replace cordless telephones with corded telephones.
- Establish wired (Ethernet) interconnections between routers and the wireless devices that the routers support. Then turn off the wireless capabilities, such as Wi-Fi and Bluetooth, of them all.
- “Opt out” of the wireless smart meter on your residence, if your state or local electric power company permits. Many states, but not all, have an opt-out provision.
- Alert family members about the health risks posed by wireless devices, particularly for vulnerable groups such as pregnant mothers, unborn children, young and teenage children, adult males of reproductive age, seniors, the disabled, and anyone with a chronic health condition. Everyone is vulnerable, but these groups are more so.

Reference: For more information on reducing radiation at home, please see Ronald M. Powell, Ph.D., How to Reduce the Electromagnetic Radiation in Your Home, which is document (10) on the following list.

[\(https://www.scribd.com/document/291507610/\)](https://www.scribd.com/document/291507610/)

We can obtain better protection if we work together.

We can contribute our efforts to the hundreds of new organizations that are emerging nationwide to raise awareness about the health risks posed by the radiation exposure from wireless devices in homes, in the workplace, in schools, and in public places, especially where children are present. Through the Internet, look for organizations that address the intersection of health with cell phones, cordless phones, Wi-Fi, smart meters, and wireless desktop computers, laptops, and tablets. These wireless devices are the principal sources of radiofrequency radiation in the home.

Take care for our children. Today's adults grew up in an environment with much less radiofrequency radiation than exists today. Today's children are not so lucky. To have the same chance at a healthy life, they need a lot of help. Unfortunately, the levels of radiofrequency radiation in our environment are rising exponentially as governments and wireless industries continue to promote, and even mandate, the exposure of the public to ever higher levels of radiofrequency radiation, with no limit in sight. That means that many of our children will become chronically ill, and many will die, while still young adults. This is a tragedy in the making. To stop it will require greatly increased awareness of the problem and serious political action at multiple levels of government. That is no small task, but we all can help. We can join with others to become a part of the solution for ourselves and our families, but especially for our children and our grandchildren.

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To Whom It May Concern:

Dear Sirs/Madams:

I am Scientist Emeritus and Former Director of the National Institute of Environmental Health Sciences and National Toxicology Program of the National Institutes of Health. I am currently a Scholar in Residence at the Nicholas School of the Environment at Duke University.

Wireless networks, cell towers and cell phones create radiofrequency radiation emissions. U.S. FCC limits for human exposure to radiofrequency were last reviewed in 1996 and based on the assumption that heating is the only harmful effect. Aware that the FCC's 1996 limits lacked the underpinning of solid scientific data regarding long term health effects, the FDA requested large-scale studies by the National Toxicology Program (NTP) and in 2018 the NTP studies found clear evidence of an association with cancer in male rats. Additionally, the NTP found heart damage and DNA damage, despite the fact that the animals were carefully exposed to non-heating RFR levels long assumed to be safe. The Ramazzini Institute animal studies used even lower RFR lower exposures to approximate cell tower emissions and also found increases of the same tumor type. The NTP studies were carefully controlled to ensure exposures did not significantly heat the animals. The animal study findings in combination with human studies indicate adverse effects from non heating levels of radiofrequency.

I document the importance of the NTP findings of effects from non thermal exposures in my declaration in [an Amicus Brief](#) for the case Environmental Health Trust et al v. the FCC. The August 13, 2021 judgment ordered the FCC to address several issues including the health implications of long term exposures.

A mounting body of published studies associates radiofrequency radiation with adverse negative health effects. FCC limits need to be strengthened to protect the public, especially children and vulnerable populations, from long term exposures.

Linda S. Birnbaum, PhD
Scientist Emeritus and Former Director
National Institute of Environmental Health Sciences and National Toxicology Program
Scholar in Residence, Duke University, Former President, Society of Toxicology
Adjunct Professor, Yale University and UNC, Chapel Hill, Visiting Professor, Queensland University (Australia)

National Toxicology Program Radiofrequency Radiation
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Massachusetts Joint Committee on Consumer Protection
Massachusetts Joint Committee on Advanced Information Technology, the Internet and Cybersecurity Committee
24 Beacon St. Room 506
Boston, MA 02133

Subject: In Support of Technology Safety Bills S. 186, S. 187, H. 115, H. 105-114

Dear Esteemed Legislators,

I am writing in support of legislation that which reduces RFR exposure, especially for children who are more vulnerable.

I am Professor Emeritus of Pediatrics and of Environmental & Occupational Health George Washington University School of Medicine and Health Sciences and George Washington University Milken Institute School of Public Health. I am also past chair of the Council on Environmental Health of the American Academy of Pediatrics, and also served on the Children's Health Protection Advisory Committee for the US EPA.

We assume that our federal health and environmental agencies regularly review the latest research and ensure that cell phones and wireless devices are safe. However, U.S. agencies which regulate cell phone radiation have not shown they have evaluated the research on children's unique vulnerability to ensure long term safety.

The reality is that US safety regulations for cell phone radiation were last set twenty-five years ago based on science that is now outdated. The Federal Communications Commission (FCC) is the primary agency responsible for regulating wireless radiation. The FCC has no expertise related to human health topics. Moreover, federal agencies like the Environmental Protection Agency or the National Cancer Institute or the Food and Drug Administration have not carried out up-to-date full scientific review of this growing technology. Just like the thousands of chemicals in our environment today, wireless radiation has not had appropriate oversight. It has slipped through the cracks.

The one agency which has carried out studies on the impact of long term exposure to electromagnetic fields and human health is the National Toxicology Program (NTP), a component of the National Institute of Environmental Health Sciences. The [NTP found](#):

- **Clear evidence of an association with tumors in the hearts of male rats.** The tumors were malignant schwannomas.
- **Some evidence of an association with tumors in the brains of male rats.** The tumors were malignant gliomas.
- **Some evidence of an association with tumors in the adrenal glands of male rats.** The tumors were benign, malignant, or complex combined pheochromocytoma.

Pediatricians have long [called](#) for an update to this outdated cell phone radiation test method because research finds children can absorb up to 10 or more times [higher wireless radiation](#) than adults into their brain, eyes and bone marrow. Children are not little adults. As we sadly learned with early childhood lead exposures leaving long-lasting impairments, the developing brain is particularly [susceptible](#). Unlike my generation, today's youth will be exposed for years and years.

Please support legislation that reduces children's radiofrequency radiation exposure and call on the federal government to strengthen human exposure limits to protect children. I am glad to answer any questions that you have.

Sincerely,



Jerome Paulson MD FAAP



January 28, 2021

Chairman Don Serotta
Town of Chester
1786 Kings Highway
Chester, NY 10918

Dear Chairman Don Serotta,

Cell antennas and cell towers should not be placed near schools and homes.

On August 13, 2021, the United States Court of Appeals for the District of Columbia Circuit [ruled in our case](#) against the FCC that the decision by the Federal Communications Commission (FCC) to retain its 1996 safety limits for human exposure to wireless radiation (which includes cell tower emissions) was “arbitrary and capricious.” One of the important aspects of the court decision was that the ruling found the FCC did not adequately explain why it ignored the impacts of long term wireless exposure, especially for children, who are more vulnerable to wireless radiation. This [ruling](#) highlights how no federal health agency has reviewed the full body of research to develop proper safety standards.

Extensive published scientific evidence indicates that radiofrequency radiation *at levels far below FCC limits* can cause [cancer](#), [increased oxidative stress](#), [genetic damage](#), structural and functional changes of the [reproductive system](#), [memory deficits](#), [behavioral problems](#), and [neurological impacts](#). We consider radiofrequency radiation (RFR) to be a human carcinogen based on the [current body](#) of evidence.

At this time we have not identified a safe level of exposure. Although radiation levels decrease as you increase your distance from a particular antenna/tower, the reality is that adding a tower or base station to a community will definitely *increase* the radiation exposure in that area and at any distance within the surrounding coverage area.

We recommend policies to reduce human exposure to RFR, especially for children. Schools are where children spend the majority of their daytime hours. Therefore we strongly recommend against installing cell towers near schools, daycares, parks, homes, or hospitals.

Recent research on people living near cell antennas has found increases in molecular markers in the blood that predict cancer. This study evaluated effects in the human blood of individuals living near mobile phone base stations (for study purposes, they chose a distance of 80 meters) compared with healthy controls living more than 300 meters from a base station. The study measured higher RFR levels in the homes of people living in homes within 80 meters from the cell antennas (documenting the impact of increased RFR radiation from the antenna installations) and found statistically significant differences in their blood. The group living closer to the antennas had statistically significant higher frequency of micronuclei and a rise in lipid peroxidation in their blood; these changes are considered biomarkers predictive of cancer ([Zothansiana et al, 2017](#)).

Please note the following facts about cell towers and cell phone radiation:

- In 2011, radiofrequency radiation was [classified](#) as a Class 2B possible carcinogen by the World Health Organization's International Agency for Research on Cancer. Between then and now, the published peer-reviewed scientific evidence has significantly increased. Now, many scientists are of the opinion that the weight of current peer-reviewed evidence supports the conclusion that radiofrequency radiation should be regarded as a human carcinogen ([Hardell and Carlberg 2017](#), [Peleg et al, 2018](#), [Miller et al 2018](#)).
- The US National Toxicology Program \$25 million animal study on long-term exposure to radiofrequency radiation found [DNA Damage, heart damage, increased brain tumors, and increased heart tumors](#) deemed "clear evidence of cancer." Importantly, this study was launched almost two decades ago by the FDA because the US government had not performed research on the long-term effects of RFR exposure and the FDA wanted data on long-term safety. In 1996, the EPA was defunded from developing proper safety standards, and since then there has been no systematic review of the science by any US agency.
- Researchers with the renowned Ramazzini Institute in Italy published [findings](#) that lab animals exposed to levels of RFR below FCC limits developed the same types of cancerous cancers as the [US National Toxicology Program](#) found in their large-scale animal study.
- An Australian [study](#) looked at RFR levels to which kindergarten children were exposed, depending on how close their school was to base stations/cell towers. Researchers equipped the children with RFR measuring devices. Researchers found that kindergartens located nearby base stations/cell towers (closer than 300 meters or approximately 330 yards) had total exposure to radiofrequency radiation (RFR or RF-EMF) more than 3 times higher than children at schools where base stations were further away than 300 meters.
- A 2018 [study](#) measured radiofrequency radiation exposures in the environment including emissions from cell phone towers, TV and FM radio broadcast antennas, cell phone

handsets, and Wi-Fi—in several countries including the United States. The researchers concluded that cell phone tower (base station) radiation emissions are the dominant contributor to RFR exposure in most outdoor areas.

- A 2015 review found that in 93 out of 100 studies, RFR exposure caused oxidative stress ([Yakymenko 2015](#)). A 2021 review again confirmed non ionizing radiation has oxidative effects ([Schuermann 2021](#)). Many well-known causes of cancer in humans (such as asbestos and arsenic) are understood to induce oxidative stress.
- Studies also show that when combined with lead or a known carcinogen, RFR has magnified the carcinogen's effects. For example, RFR at levels far below FCC limits more than doubled the numbers of liver and lung tumors in carcinogen-exposed mice ([Lerchl 2015](#)).
- The International Association of Firefighters has officially opposed cell towers on their stations since 2004 after a study [found](#) neurological damage in firefighters with antennas on their fire station. In 2017, when 5G “small cells” were coming to California via a 5G streamlining bill (SB 649), firefighter organizations came out in strong opposition to the bill and requested that towers not be installed on firehouses. They were successful and SB649 was [amended](#) to [exempt](#) their stations from the deployment due to their health concerns.
- Published research finds the frequencies impact wildlife. For example, studies have found that the radiation alters bird navigation and disturbs honeybee colonies. Research also shows adverse impacts on trees and plants. ([Research on EMF and Bees](#), [Research on Wildlife](#) [Research on Trees](#))
- A 2019 [study](#) of students in schools near cell towers found their higher RF exposure was associated with impacts on motor skills, memory, and attention ([Meo 2019](#)). Examples of other effects linked to cell towers in research studies include [neuropsychiatric problems](#), [elevated diabetes](#), [headaches](#), [sleep problems](#), and [genetic damage](#). Such research continues to accumulate after the 2010 landmark [review study](#) on 56 studies that reported biological effects found at very low intensities of wireless radiation, including impacts on reproduction, permeability of the blood-brain barrier, behavior, cellular changes, and metabolic changes, and increases in cancer risk ([Lai and Levitt 2010](#)).
- The [International EMF Scientist Appeal](#) was submitted to the United Nations urging immediate protective policy action in light of the scientific evidence that has found adverse biological effects from electromagnetic radiation, including radiofrequency radiation, and, as of January 2019, this Appeal is signed by 247 scientists from 42 nations; these are scientists who have published peer-reviewed articles about electromagnetic fields. They state, “numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines. Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being.”

The exposure limits of the US Federal Communications Commission are totally outdated and do not protect the health of the public, especially not the health of children. The Los Angeles School District has banned cell towers on their District's school grounds.

Please note that in several countries, governments have set policies to protect children, pregnant women, and medically fragile persons by classifying areas with homes, hospitals, and schools as "sensitive areas." Some examples include:

- In India the government has set RFR limits to 1/10th of ICNIRP and the Brihanmumbai Municipal Corporation, Zilla Parishad, Rajasthan, and Mumbai have banned cell antenna/tower installations on schools.
- Greece has banned the installation of mobile phone base stations at the premises of schools, kindergartens, hospitals, or eldercare facilities.
- Chile's "Antenna Law" prohibits cell antennas/towers in "sensitive areas" (educational institutions, nurseries, kindergartens, hospitals, clinics, nursing homes).
- Several countries have [lower allowable RFR limits](#) in "sensitive" areas.

EHT's position is that children require special protections from radiofrequency radiation and their exposures should be reduced to as low as possible. We strongly recommend against cell tower/antenna placements at schools or near homes as this would increase daily RFR exposure.

Please feel free to contact us with more questions.

Sincerely,

Devra Davis, PhD, MPH
President and Founder, Environmental Health Trust
Visiting Professor, Hebrew University Hadassah Medical Center
<https://ehtrust.org>

Anthony B. Miller, MD
Professor Emeritus at the Dalla Lana School of Public Health, University of Toronto
Senior Advisor to Environmental Health Trust

Dr. Hugh Scully Testimony to the City of Toronto

(Past-President of Ontario Medical Association, Past-President of Canadian Medical Association, Past-President of Canadian Cardiovascular Society.)

As a physician leader in Canada with a great commitment to the health of Canadians, I am very concerned about the increasing evidence internationally that EMR is creating increasing health problems in our population as its use increases exponentially. This is particularly true among children and young Canadians, and teachers and nurses who are continuously exposed to WiFi routers in schools [and hospitals].

As a cardiac specialist, I am concerned that approximately 20% of people have detrimental cardiac rhythm sensitivity to EMR.

This issue is under active consideration by the Health and Public Policy Committee of the Royal College of Physicians and Surgeons of Canada, the Health Policy and Public Health Committees of the Canadian Medical Association and the Council of Family Physicians of Canada, the Canadian Pediatric Society and the Canadian Cardiovascular Society.

There is an abundance of evidence from around the world that EMR can be harmful to health. Many countries...not Canada or the United States...have initiated policies to mitigate the risks. We, in Canada, need to do the same or more.

It is imperative that City of Toronto does not install WiFi's in public parks and spaces. I ask you to vote against Councillor Matlow's proposal.

Sincerely,

Dr. Hugh Scully, BA,MD,MSc,FRSC[C],FACS

Professor of Surgery and Health Policy, University of Toronto, Past-President, OMA, CMA, CCS, Former Member of Council [Board], RCPSC and WMA, Member, Health Policy Advisory Council, American College of Surgeons.

HARVARD MEDICAL SCHOOL

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December 12, 2015

Montgomery County Schools
Carver Educational Services Center
850 Hungerford Drive
Rockville, MD 20850

cc Montgomery County City Council

Dear Montgomery County School District,

I am a pediatric neurologist and neuroscientist on the faculty of Harvard Medical School and on staff at the Massachusetts General Hospital. I am Board Certified in Neurology with Special Competency in Child Neurology, and Subspecialty Certification in Neurodevelopmental Disorders.

I have an extensive history of research and clinical practice in neurodevelopmental disorders, particularly autism spectrum disorders. I have published papers in brain imaging research, in physiological abnormalities in autism spectrum disorders, and in environmental influences on neurodevelopmental disorders such as autism and on brain development and function.

A few years ago I accepted an invitation to review literature pertinent to a potential link between Autism Spectrum Disorders and Electromagnetic Frequencies (EMF) and Radiofrequency Radiation (RFR). I set out to write a paper of modest length, but found much more literature than I had anticipated to review. I ended up producing a 60 page single spaced paper with over 550 citations. It is available at http://www.bioinitiative.org/report/wp-content/uploads/pdfs/sec20_2012_Findings_in_Autism.pdf and it was published in a revised and somewhat shortened form in two parts in the peer reviewed indexed journal *Pathophysiology* (2013) with the title: "Autism and EMF? Plausibility of a pathophysiological link." Please also see the appendix to this letter which contains a summary of this material and includes substantial scientific citations.

More recently I published an article entitled "[Connections in Our Environment: Sizing up Electromagnetic Fields.](#)" in *Autism Notebook Spring 2015* edition in which I summarized and personalized the information in the . In this article I describe how here is a whole series of problems at the cellular, sub-cellular and metabolic levels and immune levels that have been identified in autism. And interestingly, for every single one of those problems, there's literature about how EMFs can create those kinds of problems.

The argument I made in these articles is not that EMF is proven to cause autism, but rather, that EMF can certainly contribute to degrading the physiological integrity of the system at the cellular and molecular level" – and this in turn appears to contribute to the pathogenesis/causation not only of autism but of many highly common chronic illnesses, including cancer, obesity, diabetes and heart disease.. Please see this article on page 24-25 at the link <http://virtualpublications.soloprinting.com/publication/?i=252361>

In fact, there are thousands of papers that have accumulated over decades –and are now accumulating at an accelerating pace, as our ability to measure impacts become more sensitive – that document adverse health and neurological impacts of EMF/RFR. Children are more vulnerable than adults, and children with chronic illnesses and/or neurodevelopmental disabilities are even more vulnerable. Elderly or chronically ill adults are more vulnerable than healthy adults.

Current technologies were designed and promulgated without taking account of biological impacts other than thermal impacts. We now know that there are a large array of impacts that have nothing to do with the heating of tissue. The claim from wifi proponents that the only concern is thermal impacts is now definitively outdated scientifically.

Radiofrequency electromagnetic radiation from wifi and cell towers can exert a disorganizing effect on the ability to learn and remember, and can also be destabilizing to immune and metabolic function. This will make it harder for some children to learn, particularly those who are already having learning or medical problems in the first place. And since half of the children in this country have some kind of chronic illness, this means that a lot of people are more vulnerable than you might expect to these issues.

Powerful industrial entities have a vested interest in leading the public to believe that EMF/RFR, which we cannot see, taste or touch, is harmless, but this is not true. Please do the right and precautionary thing for our children.

I urge you to opt for wired technologies in Montgomery County classrooms, particularly for those subpopulations that are most sensitive. It will be easier for you to make a healthier decision now than to undo misguided decisions later.

Thank you.



Martha Herbert, PhD, MD

Selected pertinent publications

[Connections in our Environment: Sizing up Electromagnetic Fields](#) by M.R. Herbert (published in Autism Notebook Spring 2015, pp. 24-25) reviews in two pages key points of the more technical Herbert & Sage Autism-EMF paper

Herbert, M.R. and Sage, C. "Autism and EMF? Plausibility of a Pathophysiological Link". [Part 1: Pathophysiology, 2013, Jun;20\(3\):191-209](#), epub Oct 4, PMID 24095003. [Pubmed abstract for Part 1](#). [Part II: Pathophysiology, 2013 Jun;20\(3\):211-34](#). Epub 2013 Oct 8, PMID 24113318. [Pubmed abstract for Part II](#).

APPENDIX: MORE DETAILED SUMMARY OF THE PATHOPHYSIOLOGY

I became interested in the health and brain effects of electromagnetic frequency (EMF) and radiofrequency radiation (RFR) exposures in relation to my brain research because I was interested in how such exposures might alter brain function. In order to familiarize myself in more detail existing literature on the pathophysiological impacts of EMF/RFR, I coauthored a 40,000 word chapter in the 2012 update of the Bioinitiative, ¹ and published an updated 30,000 word version of that paper ("Autism and EMF? Plausibility of a Pathophysiological Link") in 2013 in two parts in the peer reviewed journal *Pathophysiology*. ^{2,3} My intention was to assess the plausibility of an association between increasing incidence of autism spectrum disorder and increasing EMF/RFR exposures. Rather than directly address the epidemiological issues, I looked at the parallels between the pathophysiological features documented in autism and the pathophysiological impacts of EMF/RFR documented in the peer-reviewed published scientific literature.

I will include here a brief summary of the paper (prepared for a lay audience) of the features of EMF/RFR that I reviewed (with citations at the end of this letter):

- EMF/RFR stresses cells. It lead to cellular stress, such as production of heat shock proteins, even when The EMF/RFR isn't intense enough to cause measurable heat increase. ⁴⁻⁶
- EMF/RFR damages cell membranes, and make them leaky, which makes it hard for them to maintain important chemical and electrical differences between what is inside and outside the membrane. This degrades metabolism in many ways – makes it inefficient. ⁷⁻¹⁵
- EMF/RFR damages mitochondria. Mitochondria are the energy factories of our cells. Mitochondria conduct their chemical reactions on their membranes. When those membranes get damaged, the mitochondria struggle to do their work and don't do it so well. Mitochondria can also be damaged through direct hits to steps in their chemical assembly line. When mitochondria get inefficient, so do we. This can hit our brains especially hard, since electrical communication and synapses in the brain demands huge amounts of energy.
- EMF/RFR creates "oxidative stress." Oxidative stress is something that occurs when the system can't keep up with the stress caused by utilizing oxygen, because the price we pay for using oxygen is that it generates free radicals. These are generated in the normal course of events, and they are "quenched" by antioxidants like we get

in fresh fruits and vegetables; but when the antioxidants can't keep up or the damage is too great, the free radicals start damaging things.

- EMF/RFR is genotoxic and damages proteins, with a major mechanism being EMF/RFR-created free radicals which damage cell membranes, DNA, proteins, anything they touch. When free radicals damage DNA they can cause mutations. This is one of the main ways that EMF/RFR is genotoxic – toxic to the genes. When they damage proteins they can cause them to fold up in peculiar ways. We are learning that diseases like Alzheimer's are related to the accumulation of mis-folded proteins, and the failure of the brain to clear out this biological trash from its tissues and fluids.
- EMF/RFR depletes glutathione, which is the body's premier antioxidant and detoxification substance. So on the one hand EMF/RFR creates damage that increases the need for antioxidants, and on the other hand they deplete those very antioxidants.^{1,16}
- EMF/RFR damages vital barriers in the body, particularly the blood-brain barrier, which protects the brain from things in the blood that might hurt the brain. When the blood-brain barrier gets leaky, cells inside the brain suffer, be damaged, and get killed.^{1,16,17}
- EMF/RFR can alter the function of calcium channels, which are openings in the cell membranes that play a huge number of vital roles in brain and body.¹⁸⁻²⁷
- EMF/RFR degrades the rich, complex integration of brainwaves, and increase the "entropy" or disorganization of signals in the brain – this means that they can become less synchronized or coordinated; such reduced brain coordination has been measured in autism.²⁸⁻⁴⁰
- EMF/RFR can interfere with sleep and the brain's production of melatonin.⁴¹⁻⁴³
- EMF/RFR can contribute to immune problems.⁴⁴⁻⁵⁰
- EMF/RFR contribute to increasing stress at the chemical, immune and electrical levels, which we experience psychologically.^{51-57 17, 58-62 63-68}

Please note that:

1. There are a lot of other things that can create similar damaging effects, such as thousands of "xenobiotic" substances that we call toxicants. Significantly, toxic chemicals (including those that contain naturally occurring toxic elements such as lead and mercury) cause damage through many of the same mechanisms outlined above.
2. In many of the experimental studies with EMF/RFR, damage could be diminished by improving nutrient status, particularly by adding antioxidants and melatonin.⁶⁹⁻⁷²

I understand that the concept of electromagnetic hypersensitivity is not always well understood in the medical and scientific communities. Indeed, the inter-individual variability is perplexing to those who would expect a more consistent set of features.

But given the range of challenges I have listed that EMF/RFR poses to core processes in biological systems, and given the inter-individually variable vulnerability across these symptoms, it is really not surprising that there would be subgroups with different combinations of symptom clusters.

It also appears to be the case that the onset and duration of symptoms or even brain response to EMR/RFR can be variable. This again is to be expected given the mediation of these symptoms through a variety of the above-listed pathophysiological processes, many of which differ in scale (ranging from molecular to cellular to tissue and organ) and time course of impact. The different parts of the body also absorb this energy differently, both

because of their biophysical properties and as a function of their state of health or compromise thereof.

Here is a list of subgroups of symptom clusters identified by a group of German physicians, t exemplifies these variability issues:

- Group 1** no symptoms
- Group 2** sleep disturbance, tiredness, depressive mood
- Group 3** headaches, restlessness, dazed state, irritability, disturbance of concentration, forgetfulness, learning difficulties, difficulty finding words
- Group 4** frequent infections, sinusitis, lymph node swellings, joint and limb pains, nerve and soft tissue pains, numbness or tingling, allergies
- Group 5** tinnitus, hearing loss, sudden hearing loss, giddiness, impaired balance, visual disturbances, eye inflammation, dry eyes
- Group 6** tachycardia, episodic hypertension, collapse
- Group 7** other symptoms: hormonal disturbances, thyroid disease, night sweats, frequent urge to urinate, weight increase, nausea, loss of appetite, nose bleeds, skin complaints, tumors, diabetes

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3 August 2016

Petaluma City Schools
District Office
200 Douglas Street
Petaluma, California 94952

Dear Sirs/Madams:

I am a public health physician who served as the Co-Editor of the Bioinitiative Report, published in 2007 as a comprehensive review of the adverse health effects of radiofrequency electromagnetic fields.

There is strong and consistent evidence that excessive exposure to radiofrequency electromagnetic fields has adverse human health effects. Of particular concern is the clear evidence that children are more vulnerable than adults. The best-documented adverse effects are an increase in risk of cancer, but cancers do not appear immediately upon exposure but rather come years later. The National Toxicology Program has within the past couple of months reported that even rats exposed to radiofrequency radiation develop brain cancer! Within a school setting there is increasing evidence that excessive exposures reduce learning ability, which is the last thing one wants in a school. Some children will also develop a syndrome of electrohypersensitivity, where they get headaches and reduced ability to pay attention and learn. While these effects are not nearly as well documented as those relating to cancer, they are particularly important within a school. This is especially the case in a wireless computer classroom, where exposure can be very high. However there will be essentially no exposure in a wired computer classroom.

The exposure levels of the Federal Communications Commission are totally outdated and do not protect the health of the public, especially of children. I urge you to abandon any plans for wireless communication within schools. It is of course critical that all children have access to the Internet, but when this is done through wired connections they will not be exposed to excessive electromagnetic fields.

Yours sincerely,



David O. Carpenter, M.D.
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4 August, 2016

Dear Petaluma City Schools;
 Superintendent Gary Callahan and Board of Trustees

Regarding: Wireless technology should not be used in schools or pre-schools due to health risks for children and employees

We have been asked to declare our opinion about wireless technology in schools by parents that are concerned about their children.

Based on current published scientific studies, we urge your administration to educate themselves on the potential risks from wireless technologies in schools, and to choose wired teaching technologies. The well-being and educational potential of children depends on it.

High-speed connectivity to schools is important but it can be a wired connection instead of Wi-Fi. Wireless classroom infrastructure and wireless devices for schoolchildren should be avoided for these reasons:

- Wireless radiofrequency (RF) radiation emissions were classified as a Possible Human Carcinogen (group 2B) by the World Health Organization International Agency for Research on Cancer (IARC) in May 2011. One of the signers, Dr Hardell, was part of the evaluation group.
- The IARC classification holds for *all forms of radio frequency radiation* including RF-EMF emissions from wireless transmitters (access points), tablets and laptops.
- Epidemiological studies show links between RF radiation exposure and cancer, neurological disorders, hormonal changes, symptoms of electrical hypersensitivity (EHS) and more. Laboratory studies show that RF radiation exposure increases risk of cancer, abnormal sperm, learning and memory deficits, and heart irregularities. Foetal exposures in both animal and human studies may result in altered brain development in the young offspring, with disruption in learning, memory and behaviour.
- Recently a report was released from The National Toxicology Program (NTP) under the National Institutes of Health (NIH) in USA on the largest ever animal study on cell phone RF radiation and cancer (<http://biorxiv.org/content/biorxiv/early/2016/05/26/055699.full.pdf>). An increased incidence of glioma and malignant schwannoma in the heart was found. Interestingly our research group and others have in epidemiological studies shown that persons using wireless phones (both mobile phones and cordless phones; DECT) have an increased risk for glioma and acoustic neuroma. Acoustic neuroma or vestibular schwannoma is the same type of tumour as the one found in the heart, although benign.
- The research showing increased brain cancer risk in humans *has strengthened* since the IARC 2011 classification as new research has been published which repeatedly shows a significant association after RF radiation exposure. In addition, tumour

promotion studies have now been replicated showing cancer promotion after exposures at low levels.

- It is our opinion and that of many colleagues that the current IARC cancer risk classification should move to an *even higher* risk group. The carcinogenic effect has been shown in human and animal studies. Several laboratory studies have shown mechanistic effects in carcinogenesis such as oxidative stress, down regulation of mRNA, DNA damage with single strand breaks.
- In summary RF radiation should be classified as Carcinogenic to Humans, Group 1 according to the IARC classification. This classification should have a major impact on prevention.

The evidence for these statements is based on hundreds of published, peer-reviewed scientific studies that report adverse health effects at levels much lower than current ICNIRP and FCC public safety limits. Compliance with government regulations does not mean that the school wireless environment is safe for children and staff (especially pregnant staff).

As researchers in cancer epidemiology and RF radiation exposures, we have published extensively in this area and it is our opinion that schools should choose wired Internet connections. Multiple epidemiological research studies show that exposures equivalent to 30 minutes a day of cell phone use over ten years results in a significantly increased brain cancer risk.

What will be the health effect for a child exposed all day long in school for 12 years? Wireless networks in schools result in full body low level RF radiation exposures that can have a cumulative effect on the developing body of a child. No safe level of this radiation has been determined by any health agency and therefore we have no safety assurances. Cancers can have long latency periods (time from first exposure until diagnosis) and it will take decades before we know the full extent of health impacts from this radiation. The statistics and effects will be borne by the children you serve.

Wi-Fi in schools, in contrast to wired Internet connections, will increase risk of neurologic impairment and long-term risk of cancer in students. Promoting wireless technology in schools disregards the current health warnings from international science and public health experts in this field.

We recommend that your school district install wired Internet connections and develop curriculum that teaches students at all ages safer ways to use their technology devices. If cell phones and other wireless devices are used in the school curriculum (as many schools are now doing with Bring your Own Device Policy) then there should be educational curriculum in place and well posted instructions in classrooms so that the students and staff use these devices in ways that reduce exposure to the radiation as much as possible.

Supporting wired educational technologies is the safe solution in contrast to potentially hazardous exposures from wireless radiation.

Respectfully submitted

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Dr. Anthony B. Miller

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August 4, 2016

Petaluma City Schools
District Office
200 Douglas Street
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94952

Re: Adverse Effects of Radiofrequency fields

I am writing to express my concern over the increasing exposure of children in schools to Radiofrequency Fields (e.g. from wi-fi, as required for cell phones and iPads, and emitted by cell towers) and the lack of concern expressed by many councils, governments and School Boards on this issue. In particular, justification for the “safety” of radiofrequency fields is placed upon the use of outdated safety standards, based upon tissue heating, whereas it has now been well demonstrated that adverse biological effects occur at far lower levels of radiofrequency fields that do not induce tissue heating, including a recent animal study performed by the National Toxicology Program in the United States which found an increased incidence of brain cancers and other cancers in rats exposed to prolonged Radiofrequency fields.

I am a physician and epidemiologist specializing in cancer etiology, prevention, and screening, expert in epidemiology, and particularly causes of human cancer. I have performed research on ionizing radiation and cancer, electromagnetic fields and cancer, and have served on many committees assessing the carcinogenicity of various exposures, including working groups of the International Agency for Research on Cancer (IARC), widely regarded as providing unbiased assessment on the carcinogenicity of chemicals and other exposure to humans.

In 2011, an IARC working group designated radiofrequency fields as a class 2B carcinogen, a possible human carcinogen. Since that review a number of additional studies have been reported. One of the most important was a large case-control study in France, which found a doubling of risk of glioma, the most malignant form of brain cancer, after two years of exposure to cell phones. After five years exposure the risk was five-fold. They also found that in those who lived in urban environments the risk was even higher. In my view, and that of many colleagues who have written papers on this issue, these studies provide evidence that radiofrequency fields are not just a possible human carcinogen but a probable human carcinogen, i.e. IARC category 2A. It would be impossible to ignore such an assessment in regulatory approaches.

It is important to recognize that there are no safe levels of exposure to human carcinogens. Risk increases with increasing intensity of exposure, and for many carcinogens, even more with increasing duration of exposure. The only way to avoid the carcinogenic risk is to avoid exposure altogether. This is why we ban known carcinogens from the environment and why much effort is taken to get people, particularly young people, not to smoke. We now recognize that exposure to carcinogens in childhood can increase the risk of cancer in adulthood many years later. Further, people vary in their genetic makeup, and certain genes can make some people more susceptible than others to the effect of carcinogens. It is the young and those who are susceptible we should protect.

As an epidemiologist who has done a great deal of work on breast cancer, I have been concerned by a series of case reports from California and elsewhere of women who developed unusual breast cancers in the exact position where they kept cell phones in their bras. These are unusual cancers. They are multifocal, mirroring where the cell phone was kept. Thus in these relatively young women the radiofrequency radiation from very close contact with a cell phone has caused breast cancer.

Not only brain and breast cancers but parotid gland tumors, tumors of the salivary gland, have been associated with prolonged exposure to cell phones.

Given the long natural history of cancer and the fact that human populations have not been exposed for a sufficient length of time to reveal the full adverse effects of radiofrequency fields, it is extremely important to adopt a precautionary approach to the exposure of humans to such fields. An individual, if appropriately informed, can reduce her or his exposure to radiofrequency fields from devices that use wi-fi, but in the case of cell towers, smart meters and wi-fi in schools, the exposure they receive is outside their control. Then, with the people who manufacture these devices and those who promote wi-fi failing to issue adequate health warnings, we are reaching a situation where schools, work places and homes are being saturated with radiofrequency fields.

Thus to avoid a potential epidemic of cancer caused by radiofrequency fields from wi-fi and other devices, we should introduce means to reduce exposure as much as reasonably achievable, use hard wire connections to the internet and strengthen the codes that are meant to protect the public.

Yours sincerely

A handwritten signature in black ink, appearing to read 'A. B. Miller', written in a cursive style.

Anthony B. Miller, MD, FRCP(C), FRCP, FACE
Professor Emeritus
Dalla Lana School of Public Health, University of Toronto, Ontario, Canada



Karolinska Institutet
Department of Neuroscience
Experimental Dermatology Unit

Stockholm, December 8, 2015

To:

MCPS CEO Dr. Andrew Zuckerman [Andrew_Zuckerman@mcpsmd.org]
MCPS Superintendent Mr. Larry Bowers [Larry_Bowers@mcpsmd.org]
MCPS Chief Technology Officer Mr. Sherwin Collette [Sherwin_Collette@mcpsmd.org]
MCPS Board of Education [boe@mcpsmd.org]
840 Hungerford Drive
Rockville, MD 20850, USA

cc:

Montgomery County Council [county.council@montgomerycountymd.gov]

Dear Madame or Sir,

My name is Olle Johansson, and I am an associate professor, heading the Experimental Dermatology Unit at Sweden's Karolinska Institute in the Department of Neuroscience. I understand you have recently made public pronouncements regarding the safety of Wi-Fi. As a neuroscientist who has been studying the biophysical and epidemiological effects of electromagnetic fields (EMFs) for over 30 years, I believe this designation is short-sighted.

Wireless communication is now being implemented in our daily life in a very fast way. At the same time, it is becoming more and more obvious that the exposure to electromagnetic fields not only may induce acute thermal effects to living organisms, but also non-thermal effects, the latter often after longer exposures. This has been demonstrated in a very large number of **non-ionizing radiation** studies and includes cellular DNA-damage, disruptions and alterations of cellular functions like increases in intracellular stimulatory pathways and calcium handling, disruption of tissue structures like the blood-brain barrier, impact on vessel and immune functions, and loss of fertility. Whereas scientists can observe and reproduce these effects in controlled laboratory experiments, epidemiological and ecological data derived from long-term exposures in well-designed case-control studies reflect this link all the way from molecular and cellular effects to the living organism up to the induction and proliferation of diseases observed in humans. It should be noted that we are not the only species at jeopardy; practically all animals, plants and bacteria may be at stake. Although epidemiological and ecological investigations as such never demonstrate causative effects, due to the vast number of confounders, they confirm the relevance of the controlled observations in the laboratories.

Many times since the early 1980s I have pointed out that the public's usage of cell phones has become the largest full-scale biological and medical experiment ever with mankind, and I was also the first person to firmly point out that this involuntary exposure violates the Nuremberg Code's principles for human experimentation, which clearly states that voluntary

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consent of human subjects is absolutely essential. Among many effects seen, the very serious one is the deterioration of the genome. Such an effect - if seen in a food item under development or in a potential pharmaceutical drug - immediately would completely ban it from further marketing and sale; genotoxic effects are not to be allowed or spread. For these reasons above, we, scientists, can not accept that children undergo an enormous health risk for their present and future, by being exposed to WI-FI in kindergardens or schools (even if the WI-FI masts/routers are not in the children's classroom). The precautionary principle has to be respected. Furthermore, when men place cell phones in their front pocket, or laptops on their laps, it should be noted that experimental studies have demonstrated that after similar exposures there is a decrease in sperm count as well as in the quality of sperm, which is a phenomenon that could affect society's overall ability to procreate in the future. Experiments in mice point to that it may be true already in 5 generations time.

Many other states including France, Russia, Israel and Germany, have employed various precautionary steps and their responses (including labelling cell phones and other transmitting devices with SAR ratings, discouraging the use of cell phones and other wireless gadgets by children, warning parents of the risks, and removing or restricting WiFi in schools and replacing it with hard-wired ethernet) as a result of the *WHO/IARC classification of radiofrequency electromagnetic radiation in 2011 as a Class 2B carcinogen as well as the earlier classification of power-frequent magnetic fields in 2001 also as a Class 2B carcinogen*, the information summarized in the Bioinitiative Reports of 2007 and 2012, and the other considerable international and independent research and reviews, that show adverse biological effects from electromagnetic fields, including heart palpitations, headaches, skin rashes, damage to DNA, mental health effects, impaired concentration, decreased problem-solving capacity, electrohypersensitivity, etc., are about to set a new standard for educational quality with due respect to children's and staff's health.

In the case of "protection from exposure to electromagnetic fields", it is thus of paramount importance to act from a prudence avoidance/precautionary principle point of view. Anything else would be highly hazardous. Total transparency of information is the key sentence here, as I believe the public does not appreciate having the complete truth revealed years after a certain catastrophe already has taken place. For instance, it shall be noted, that today's recommended values for wireless systems, such as the SAR-values, are just recommendations, and not safety levels. Since scientists observe biological effects at as low as 20 microWatts/kg, can it truly be stated that it is safe to allow irradiation of humans at SAR 2 W/kg, or at 100,000 times stronger levels of radiation?

IMBALANCED REPORTING

Another misunderstanding is the use of scientific publications (as the tobacco industry did for many years) as 'weights' to balance each other. But one can NEVER balance a report showing a negative health effect with one showing no effect. This is a misunderstanding which, unfortunately, is very often used both by the industrial representatives as well as official authorities to the detriment of the general public. True balance would be reports showing negative health effects against *exact replications* showing no or positive effects. However, this is not what the public has been led to believe.

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NEED FOR INDEPENDENT RESEARCH

In many commentaries, debate articles and public lectures - for the last 20-30 years – I have urged that completely independent research projects must be inaugurated immediately to ensure our public health. These projects must be entirely independent of all types of commercial interests; public health can not have a price-tag! It is also of paramount importance that scientists involved in such projects must be free of any carrier considerations and that the funding needed is covered to 100%, not 99% or less. This is the clear responsibility of the democratically elected body of every country.

WHO/INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (IARC), 2011
Very recently (in Lyon, France, May 31, 2011) the WHO/International Agency for Research on Cancer (IARC) has classified radiofrequency electromagnetic fields as possibly carcinogenic to humans (Group 2B), based on an increased risk for glioma, a malignant type of brain cancer. This should be added to the previous (2001) 2B classification of power-frequent (ELF) electromagnetic fields – emitted at high levels from handheld gadgets, such as eReaders and mobile phones – as a risk factor for childhood leukemia. Given the 2001 very close votes (9 to 11) for moving it to 2A and all the new knowledge that has accumulated since 2001, today the association between childhood leukemia and power-frequent (ELF) electromagnetic fields would definitely be signed into the much more serious 2A (“probably carcinogenic”) category. So, the ‘red flag’ is – unfortunately – flying very high.

INVOLUNTARY EXPOSURE

According to Article 24 of the UNICEF’s Child Convention “children have the right to ... a clean and safe environment, and information to help them stay healthy”. We must all ensure that this article never is violated. This is about our social responsibility, and is very much a public health issue.

In summary, electromagnetic fields may be among the most serious and overlooked health issues today, and having these fields checked and reduced/removed from schools and kindergardens may be essential for health protection and restoration, and is a must for persons with the functional impairment electrohypersensitivity as for children who are more fragile (cf. Belyaev I, Dean A, Eger H, Hubmann G, Jandrisovits R, Johansson O, Kern M, Kundi M, Lercher P, Mosgöller W, Moshammer H, Müller K, Oberfeld G, Ohnsorge P, Pelzmann P, Scheingraber C, Thill R, "EUROPAEM EMF Guideline 2015 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses", Rev Environ Health 2015; 30: 337–371). In addition, as recently discussed in a think-tank group here in Stockholm, it is very important to constantly educate oneself and participate in the general debate and public discussions to keep the information build-up active. Thus, it is of paramount importance to keep the "kettle boiling", never blindly trusting or accepting given 'facts', but only read and think for yourself and for your loved ones. Only so you can arrive at a genuinely working precautionary principle.

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CONCLUSION

In conclusion, wireless systems, such as Wi-Fi routers or cell towers, and their electromagnetic fields, can not be regarded as safe in schools, but must be deemed highly hazardous and unsafe for the children as well as for the staff.

I encourage governments and local health and educational bodies to adopt a framework of guidelines for public and occupational EMF exposure that reflect the Precautionary Principle. As noted, the Precautionary Principle states when there are indications of possible adverse effects, though they remain uncertain, the risks from doing nothing may be far greater than the risks of taking action to control these exposures. The Precautionary Principle shifts the burden of proof from those suspecting a risk to those who discount it — as some nations have already done. Precautionary strategies should be based on design and performance standards and may not necessarily define numerical thresholds because such thresholds may erroneously be interpreted as levels below which no adverse effect can occur.

Some 100 years back, we learned the hard lessons of ionizing radiation and the need for strict health protections – now we must openly face the possibility that we must take a seat in life's school and learn again. This time it is about non-ionizing radiation.

Based on all of the above, I strongly urge you to reconsider your public stance on the safety of Wi-Fi, cell towers, and similar systems in schools as their non-ionizing radiation emissions very likely are hazardous and unsafe for students, staff and teachers.

With my very best regards
Yours sincerely
Olle Johansson

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MCPS COO Dr. Andrew Zuckerman
MCPS Interim Superintendent Larry Bowers
MCPS Board of Education
MCPS Office of Technology
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Carver Educational Services Center
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January 3, 2016

Dear Montgomery County COO Dr. Andrew Zuckerman, Interim Superintendent Larry Bowers,
Board of Education and Office of Technology;

I have been asked to comment on the [MCPS Statement Concerning Deployment of Wireless Computing Technologies](#). I am happy to do so.

The first paragraph in that statement is not relevant to the issue at hand because it is perfectly possible to use wired communication for such education. This document is being produced on a computer on which I only use wired communication, connecting to the internet, connecting to my printer and for other purposes, as well.

The 2nd and 3rd paragraphs of your statement may well be technically correct. However these give us no assurance whatsoever of safety of Wi-Fi fields. The FCC guidelines as are many other such guidelines, are based on the assumption that only heating effects of microwave/lower frequency EMFs can have biological effects. However that assumption has been falsified by thousands of studies published from the 1950s to the present, each showing that non-thermal levels of exposure often produce biological effects. For example, in 1971, the U.S. Office of Naval Medical Research produced a document reporting over 100 different non-thermal effects [1], listing 40 apparent neuropsychiatric changes produced by non-thermal microwave frequency exposures, including 5 central/peripheral nervous system (NS) changes, 9 central NS effects, 4 autonomic system effects, 17 psychological disorders, 4 behavioral changes and 2 misc. effects [1]. It also listed cardiac effects including ECG changes and cardiac necrosis as well as both hypotension and hypertension, and also 8 different endocrine effects.

Changes affecting fertility included tubular degeneration in the testis, decreased spermatogenesis, altered sex ratio, altered menstrual activity, altered fetal development, programmed cell death (what is now known as apoptosis) and decreased lactation. Many other non-thermal changes were also listed for a total of over 100 non-thermal effects. They also provided [1] approximately 2000 citations documenting these various health effects. That was almost 45 years ago and is only the beginning of the evidence for the existence of non-thermal effects. My own recent paper [2] shows that widespread neuropsychiatric effects are caused by non-thermal exposures to many different microwave frequency electromagnetic fields (EMFs).

Tolgskaya and Gordon [3] in 1973 published a long and detailed review of effects of microwave and lower frequency EMFs on experimental animals, mostly rodents. They report that non-thermal exposures impact many tissues, with the nervous system being the most sensitive organ in the body, based on histological studies, followed by the heart and the testis. They also report effects of non-thermal exposures on liver, kidney, endocrine and many other organs. The nervous system effects are very extensive and include changes many changes in cell structure, disfunction of synaptic connections between neurons and programmed cell death and are discussed in Refs. [2,3] and more modern studies reporting extensive effects of such non-thermal EMF exposures on the brain are also cited in [2]. There are also many modern studies showing effects of non-thermal exposures on fertility in animals.

The Raines 1981 National Aeronautics and Space Administration (NASA) report [4] reviewed an extensive literature based on occupational exposures to non-thermal microwave EMFs. Based on multiple studies, Raines [4] reports that 19 neuropsychiatric effects are associated with occupational microwave/ radiofrequency EMFs, as well as cardiac effects, endocrine including neuroendocrine effects and several other effects.

I reviewed many other scientific reviews on this topic, each of which clearly supports the view that there are various non-thermal health impacts of these EMFs [5]. In 2015, 206 international scientists signed [a statement](#) sent to the United Nations Secretary General and to member states, stating that international safety guidelines and standards are inadequate to protect human health [6]. Each of these 206 scientists from 40 countries had scientific publications on biological effects of such EMFs and therefore each is well qualified to judge this. ***It can be seen from this statement to the UN, that there is a strong scientific consensus that current safety guidelines and standards are inadequate because they do not take into consideration all of the non-thermal health effects produced by various EMF exposures.***

That scientific consensus also rejects, therefore, the FCC EMF guidelines, guidelines that cannot be defended despite your own attempt to do so in MCPS Statement Concerning Deployment of Wireless Computing Technologies.

It can be seen from the previous paragraphs, that the following non-thermal effects of EMF exposures are well documented:

- Ø Widespread neuropsychiatric effects
- Ø Several types of endocrine (that is hormonal) effects
- Ø Cardiac effects impacting the electrocardiogram (Note: these are often associated with occurrence of sudden cardiac death)
- Ø Male infertility

However, there are many additional types of biological changes produced by non-thermal EMF exposures (reviewed in 5,7] including:

- Ø Oxidative stress
- Ø Changes in calcium fluxes and calcium signaling
- Ø Several types of DNA damage to the cells of the body, including single strand and double strand DNA breaks and 8-OH-guanine in DNA
- Ø Cancer (which is undoubtedly caused, in part, by such DNA damage)
- Ø Female infertility
- Ø Lowered melatonin; sleep disruption
- Ø Therapeutic effects of EMFs when they are highly controlled and focused on a specific part of the body

It can be seen from the above, that each of the things that we most value as individuals and as a species are being attacked by non-thermal microwave frequency EMFs [5.7]:

§ **Our Health**

§ **Our brain function**

§ **The integrity of our genomes**

§ **Our ability to produce healthy offspring**

I want to emphasize that the specific health effects listed above are **not** the only things that are likely to be impacted by non-thermal EMF exposures, they are however the best documented such effects.

While it has been clear for many years that there are many non-thermal health effects of microwave frequency EMFs, it has not been clear until about 2 ½ years ago, how these effects are produced by such exposures. I stumbled onto the mechanism in 2012 and published on it in mid-2013. This 2013 paper [8] was honored by being placed on the Global Medical Discovery web site as one of the most important medical papers of 2013. At this writing, it has been cited 61 times according to the Google Scholar database, with over 2/3rds of those citations during 2015. So clearly it is having a substantial and rapidly increasing impact on the scientific literature. I have given 26 professional talks, in part or in whole on EMF effects in 10 different countries over the last 2 1/4 years. So it is clear that there has been a tremendous amount of interest in this research.

What the 2013 study showed [8], was that in 24 different studies (and there are now 2 more that can now be added [2]), effects of low-intensity EMFs, both microwave frequency and lower frequency EMFs could be blocked by calcium channel blockers, drugs that block what are called voltage-gated calcium channels (VGCCs). There were a total of 5 different types of calcium

channel blocker drugs used in these studies, with each type acting on a different site on the VGCCs and each thought to be highly specific for blocking VGCCs. What these studies tell us is that these EMFs act to produce non-thermal effects by activating the VGCCs. Where several effects were studied, when one of them was blocked or greatly lowered, each other effect studied was also blocked or greatly lowered. This tells us that the role of VGCC activation is quite wide – many effects go through that mechanism, possibly even all non-thermal effects in mammals. There are a number of other types of evidence confirming this mechanism of action of microwave frequency EMFs [2,]. Each of the 11 health impacts caused by non-thermal EMF exposures can be explained as being produced by indirect effects of VGCC activation [5,7].

It is now apparent [7] that these EMFs act directly on the voltage sensor of the VGCCs, the part of the VGCC protein that detects electrical changes and can open the channel in response to electrical changes. The voltage sensor (and this is shown on pp. 102-104 in [7]) is predicted, because of its structure and its location in the plasma membrane of the cell, to be extraordinarily sensitive to activation by these EMFs, about 7.2 million times more sensitive than are single charged groups elsewhere in the cell. What this means is that arguments that EMFs produced by particular devices are too weak to produce biological effects, are immediately highly suspect because the actual target, the voltage sensor of the VGCCs is extremely sensitive to these EMFs. **Because heating is mostly produced by forces on these singly charged groups elsewhere in the cell, limiting safety guidelines to heating effects means that these guideline allow exposures that are something like 7.2 million times too high.**

Why then does the FCC stick with these totally unscientific safety guidelines? That is the 64 billion dollar question. The FCC has been shown, in a long detailed document published by Harvard University Center for Ethics, to be a “captured agency”, that is captured by the telecommunications industry that the FCC is supposed to be regulating [9; can be obtained full text from web site listed in 9]. So perhaps the failure of the FCC to follow the extensive science in this important area, can be understood. Of course, what that means is that the FCC is completely failing in its role of protecting the public and it is a major blunder, therefore for either you or any other organization to depend on the FCC guideline as a reliable predictor of impacts of EMFs in humans.

So what is known about health impacts of Wi-Fi EMFs?

Table 1. The following Table summarizes various health impacts of Wi-Fi EMF exposures:

Citation(s)	Health Effects
[10,11,12,13,14,15,16]	Sperm/testicular damage, male infertility
[10,15,17,18,19,20]	Oxidative stress
[20]	Calcium overload

[11,12,20]	Apoptosis (programmed cell death)
[17]	Melatonin lowering; sleep disruption
[10,13]	Cellular DNA damage
[21]	MicroRNA expression (brain)
[18]	Disrupts development of teeth
[22]	Cardiac changes, blood pressure disruption; erythrocyte damage; catecholamine elevation
[23,24]	Neuropsych changes including EEG
[25]	Growth stimulation of adipose stem cells (role in obesity?)

Each of the effects reported above in 2 to 7 studies have an extensive literature for their occurring in response to various other microwave frequency EMFs so it should be clear that these observations on Wi-Fi exposures are highly probable to be correct. These include (see Table 1) findings that Wi-Fi exposures produce impacts on the testes leading to lowered male fertility; oxidative stress; intracellular calcium overload; apoptosis (a process that has an important causal role in neurodegenerative diseases); cellular DNA damage; neuropsychiatric changes including EEG changes. Each of these are very serious and oxidative stress has causal roles in many different human diseases; intracellular calcium overload has many different consequences – for example, it has a central role in causing neurodegenerative diseases; cellular DNA damage can cause cancer and produce mutations that impact future generations (if there are any). Other Wi-Fi effects each only documented by a single study are also effects where a variety of other non-thermal microwave EMFs also cause these, as shown by extensive literature on each of them. These include: melatonin lowering and sleep disruption; and the effects reported by Sali et al [22] cardiac changes, blood pressure disruption; erythrocyte damage; catecholamine elevation. So these may well be correct observations as well despite having only a single Wi-Fi specific study for each.

Summary:

1. The EMF safety guidelines supported by the FCC and others assume that only heating effects need be of concern. These assumptions have been known to be false for at least 45 years and there is a scientific consensus on this, that has lead to the petition by 206 highly qualified international scientists to the UN stating that current safety guidelines are inadequate.
 2. We now know that low intensity non-thermal exposures work via VGCC activation and that indirect effects of such VGCC activation can produce each of the health effects that have been widely reported to occur in response to such EMF exposures for something like 60 years.
- These attack:

a. Our health

- b. Our brain function**
- c. The integrity of our genomes**
- d. Our ability to produce healthy offspring**

3. The voltage sensor of the VGCCs is stunningly sensitive to such low intensity EMFs, about 7.2 million times more sensitive than are singly charge groups elsewhere in our cells. The consequence of this is that safety guidelines allow exposures that are very roughly 7.2 million times too high.

4. The FCC has been shown, in a detailed Harvard University study, to be a Captured Agency, captured by the industry that it is supposed to be regulating. This provides an additional reason to be very highly skeptical about all FCC safety guidelines.

5. 15 studies have each shown health effects of Wi-Fi, most of which have also been shown to occur in response to low intensity exposures to other types of microwave frequency EMFs. These are likely to have massive health effects by producing male infertility (female infertility has not been studied in response to Wi-Fi), oxidative stress (involved in dozens of human diseases), cellular DNA damage (possibly leading to both cancer and mutations in future generations), life threatening cardiac effects, cellular apoptosis and also intracellular calcium overload (with both of these possibly leading to neurodegenerative diseases), various neuropsychiatric changes and many others.

It is my view that it is sheer insanity to fail to see the threat to our and to all human civilization by continuing to ignore the threats from such EMFs, starting with Wi-Fi.

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Columbia University, College of Physicians and Surgeons
Department of Physiology and Cellular Biophysics

Board Member
Los Angeles Unified School District,
Board of Education

Re: Health effects of cell tower radiation

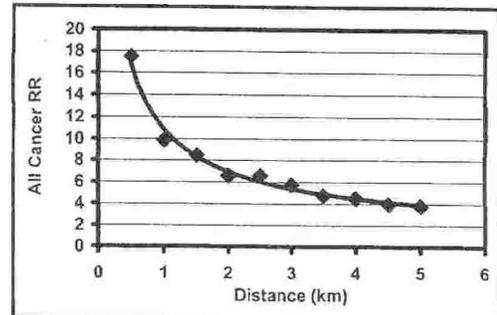
As an active researcher on biological effects of electromagnetic fields (EMF) for over twenty five years at Columbia University, as well as one of the organizers of the 2007 online Bioinitiative Report on the subject, I am writing in support of a limit on the construction of cell towers in the vicinity of schools.

There is now sufficient scientific data about the biological effects of EMF, and in particular about radiofrequency (RF) radiation, to argue for adoption of precautionary measures. We can state unequivocally that EMF can cause single and double strand DNA breakage at exposure levels that are considered safe under the FCC guidelines in the USA. As I shall illustrate below, there are also epidemiology studies that show an increased risk of cancers associated with exposure to RF. Since we know that an accumulation of changes or mutations in DNA is associated with cancer, there is good reason to believe that the elevated rates of cancers among persons living near RF towers are probably linked to DNA damage caused by EMF. Because of the nature of EMF exposure and the length of time it takes for most cancers to develop, one cannot expect ‘conclusive proof’ such as the link between helicobacter pylori and gastric ulcer. (That link was recently demonstrated by the Australian doctor who proved a link conclusively by swallowing the bacteria and getting the disease.) However, there is enough evidence of a plausible mechanism to link EMF exposure to increased risk of cancer, and therefore of a need to limit exposure, especially of children.

EMF have been shown to cause other potentially harmful biological effects, such as leakage of the blood brain barrier that can lead to damage of neurons in the brain, increased micronuclei (DNA fragments) in human blood lymphocytes, all at EMF exposures well below the limits in the current FCC guidelines. Probably the most convincing evidence of potential harm comes from living cells themselves when they start to manufacture stress proteins upon exposure to EMF. The stress response occurs with a number of potentially harmful environmental factors, such as elevated temperature, changes in pH, toxic metals, etc. This means that *when stress protein synthesis is stimulated by radiofrequency or power frequency EMF, the body is telling us in its own language that RF exposure is potentially harmful.*

There have been several attempts to measure the health risks associated with exposure to RF, and I can best summarize the findings with a graph from the study by Dr. Neil Cherry of all childhood cancers around the Sutro Tower in San Francisco between the years 1937 and 1988. Similar studies with similar results were done around broadcasting antennas in Sydney, Australia and Rome, Italy, and there are now studies of effects of cellphones on brain cancer. The Sutro tower contains antennas for broadcasting FM (54.7 kW), TV (616 kW) and UHF (18.3 MW) signals over a fairly wide area, and while the fields are not uniform, and also vary during the day, the fields were measured and average values estimated, so that one could associate the cancer risk with the degree of EMF exposure.

The data in the figure are the risk ratios (RR) for a total of 123 cases of childhood cancer from a population of 50,686 children, and include a 51 cases of leukaemia, 35 cases of brain cancer and 37 cases of lymphatic cancer. It is clear from the results that the risk ratio for all childhood cancers is elevated in the area studied, and while the risk falls off with radial distance from the antennas, as expected, it is still above a risk ratio of 5 even at a distance of 3km where the field was $1\mu\text{W}/\text{cm}^2$. This figure is what we can expect from prolonged RF exposure. In the Bioinitiative Report, we recommended $0.1\mu\text{W}/\text{cm}^2$ as a desirable precautionary level based on this and related studies, including recent studies of brain cancer and cellphone exposure.



As I mentioned above, many potentially harmful effects, such as the stress response and DNA strand breaks, occur at nonthermal levels (field strengths that do not cause a temperature increase) and are therefore considered safe. It is obvious that the safety standards must be revised downward to take into account the nonthermal as well as thermal biological responses that occur at much lower intensities. Since we cannot rely on the current standards, it is best to act according to the precautionary principle, the approach advocated by the European Union and the scientists involved in the Bioinitiative report. In light of the current evidence, the precautionary approach appears to be the most reasonable for those who must protect the health and welfare of the public and especially its most vulnerable members, children of school-age.

Sincerely yours,

Martin Blank, Ph.D.

Associate Professor of Physiology and Cellular Biophysics



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MCPS COO Dr. Andrew Zuckerman
MCPS Interim Superintendent Larry Bowers
MCPS Board of Education
MCPS Office of Technology
Montgomery County Schools
Carver Educational Services Center
850 Hungerford Drive
Rockville, MD 20850

December 13, 2015

Dear Montgomery County COO Dr. Andrew Zuckerman, Interim Superintendent Larry Bowers, Board of Education and Office of Technology;

In my capacity as a pediatric occupational therapist, biologist, international speaker, and author on the subject of the impact of technology on child development and learning, I'm writing to you on behalf of students, teachers, and parents requesting you reconsider the use of devices which operate using wireless radiation.

Please find below guiding principles regarding managed balance between technology and healthy activity, as well as information on wireless radiation. More judicious use of educational based technologies in a safe manner, will serve to ensure sustainable futures for all children. Reversion to Ethernet or fiber optic cable devices, until such time as the World Health Organization deems wireless to not be harmful to young children, is recommended.

Guiding principles for the use of educational based technology in school environments.

Minimize Risk and Maximize Safety.

- Wireless radiation has not been proven safe (WHO 2011).
- Recent research indicates wireless radiation causes harmful effects to adult humans (Avendano 2012, Hardell 2013).
- Long term effects of wireless radiation on children are unknown at this time (AAP 2013).
- Children have thinner skulls, more aqueous bodies, and have rapidly developing cells, indicating they are exceedingly more vulnerable to harmful effects from wireless radiation than adults (AAP 2013, C4ST 2015).
- The American Academy of Pediatrics and the Canadian Pediatric Society recommends no more than 1-2 hours total technology use per day, including

educational technology. Many schools exceed these expert guidelines (AAP 2014).

Weigh Risk vs. Benefit.

- Education technology is not evidence based and is laden with conflict of interest e.g. manufacturers claims are financially motivated, and are not substantiated by university level research.
- Traditional and standardized teaching methods have substantive research support and evidence, yet are being rapidly replaced with education technology.

Ensure adequate foundational skills prior to use of technology.

Children need to balance the following 4 critical factors with technology, to optimize development and learning. Time spent with technology adversely affects these factors.

- *Movement*: stimulates vestibular, proprioceptive and cardiovascular systems.
- *Touch*: stimulates parasympathetic system for lowered cortisol and adrenalin.
- *Human Connection*: activates parasympathetic system; a life sustaining force.
- *Nature*: attention restorative, improves learning, erases effects of technology.
- *See video*: [Message to Schools on EdTech](#)

Risks associated with the use of technology by children are as follows:

- *Sedentary nature* of technology use is causally related to the recent rise in obesity/diabetes, developmental delay and learning difficulties (Tremblay 2011, HELP EDI Mapping 2009/13, Ratey 2008, PISA 2012).
- *Isolating factor* of technology use is associated with escalation in social impairments, mental illnesses (including adhd and autism), and self-regulation difficulties (Houtrow 2014).
- *Overstimulation* from technology use is a causal factor in rise in attention deficit, aggression, sleep disturbance, and chronic stress from hyper-arousal of the sympathetic nervous system (Christakis 2004, Gentile 2009, Markman 2010, Bristol University 2010).
- *Neglect* of students by teachers and support staff who are engaged in their own personal technology, is unfortunately common.
- Consequently, the risks associated with using education technology far outweigh the dubious benefits.

When In Doubt, Act With Caution.

- Existing research on harmful effects of wireless radiation on *adults*, indicates taking a cautionary approach when considering same radiation exposure to *children* (AAP 2014).

- Rapid cell turnover in children creates particular concern regarding potential DNA damage from wireless radiation, and consequent susceptibility to cancer. While rise in cancer incidence is becoming more apparent, rise in rates of cancer in children will not be observable until adulthood.
- Removal of wireless radiation and reversion to Ethernet cabled devices, will ensure immediate and long term safety to all students, teachers, and support staff.
- Defaulting to a remote authority regarding removing wireless radiation from schools, is not acting in the best interests of students and staff, and may not be defensible in a court of law.

Montgomery County's statement that the radiofrequency levels in schools "is compliant" with federal regulations *does not* assure safety to the students in your care. The current proposed technology plan to further increase the use of screens in classrooms on a daily basis, clearly does not support children's healthy development.

The implications of failure of schools to act with caution now regarding wireless radiation and technology, could potentially be horrific in both scope and magnitude, and may constitute neglect of children. Please act now to safeguard your children's future.

Respectfully,

CRowan

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Montgomery County Board of Education
Montgomery County Schools
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January 20, 2016

Dear Montgomery County Board of Education,

Concerned parents in your school district have asked me to write to you regarding the health risks of wireless radiofrequency radiation exposure in the classroom. Based on what I have been told, I want to urge you to halt programs that currently have students use their own phones in ways that expose their eyes and brains to levels of radiation that have never been tested for safety.

I was Founding Director of the Board on Environmental Studies and Toxicology of the U.S. National Research Council, and Founding Director of the Center for Environmental Oncology at the University of Pittsburgh Cancer Institute. President Clinton appointed me to the Chemical Safety and Hazard Investigation Board, and I am former Senior Advisor to the Assistant Secretary for Health in the Department of Health and Human Services. I founded the non-profit Environmental Health Trust in 2007 to provide basic research and education about environmental health hazards. Our scientific team is currently focusing on the health risks of radiofrequency radiation as an important public health issue.

Many people are unaware that cell phones and wireless laptops and tablets function as two-way microwave radios. A typical classroom might have the following scenario: every student has a laptop--which is typically tested for use 8 inches from an adult male body--a cell phone in the pocket--which is also tested at a minimum distance from an adult male body-- and a network transmitter on the ceiling and possibly a cell tower outside next to the sports field. All these devices emit microwave radiation which can be readily absorbed into children's bodies and brains.

Manufacturers specifically recommend that cell phones be used “as tested”—at this little-known minimum distance from the body. Recently, [*Consumer Reports*](#) in November advised that people should not keep phones in the pocket—advice that few children or adults appreciate. *These devices have never been tested for safety with children.* Accumulating research indicates that long-term exposure to low levels over long lifetimes could pose a serious risk to our health.

Regarding tested distances for using laptops, the Federal Communications Commission (FCC) states that laptops and computers are “mobile devices are transmitters designed to be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons.” The body in this instance refers to a large male weighing more than 200 pounds and standing six feet tall.

As the county is preparing to increase student use of Chromebooks, please be aware that the Samsung [Chromebook manual](#) states:

“United States of America USA and Canada Safety Requirements and Notices

- Do not touch or move antenna while the unit is transmitting or receiving.
- Do not hold any component containing the radio such that the antenna is very close or touching any exposed parts of the body, especially the face or eyes, while transmitting.
- Regardless of the power levels, care should be taken to minimize human contact during normal operation.
- This device should be used more than 20 cm (8 inches) from the body when wireless devices are on and transmitting.
- FCC Statement for Wireless LAN use: *“While installing and operating this transmitter and antenna combination the radio frequency exposure limit of 1mW/cm² may be exceeded at distances close to the antenna installed. Therefore, the user must maintain a minimum distance of 20cm from the antenna at all times.”*

As one of the leaders in educational policy of this nation, your school district has an opportunity to set an example for school districts nationwide by installing safer technology in classrooms and educating students, teachers and staff about tested distances that devices should be used to reduce radiation. A number of public and private schools have already implemented such policies. Just as we provide children with seat belts and bike helmets, a precautionary approach to wireless is recommended by many scientists and governments worldwide.

For more information about all of these issues, please read cell phone instructions for various models at <http://showthefineprint.org>. Our [newly posted Ebook](#) also details fine print safety instructions in wireless device user manuals.

When children use these devices close to their bodies, they are exceeding these safety instructions, and exposing themselves to radiofrequency (RF) radiation levels which can exceed our government FCC RF radiation exposure limits. The FCC RF exposure limit was designed to protect the public from the thermal (heating) effects of acute exposure to RF energy. The FCC states, “Tissue damage in humans could occur during exposure to high RF levels because of the body's inability to cope with or dissipate the excessive heat that could be generated. Two areas of the body, the eyes and the testes, are particularly vulnerable to RF heating because of the relative lack of available blood flow to dissipate the excess heat load.”

CHILDREN ABSORB MORE RADIATION THAN ADULTS

Our recently published research in the [IEEE Spectrum](#) with investigators at the Federal Universities of Brazil provides new state-of-the-art radiation exposure brain modeling which confirms that substantially higher radiofrequency radiation doses occur in younger children as compared to adults even where products comply with tested guidelines developed for adults.

FCC REGULATIONS ARE OUTDATED

FCC exposure limits were set more than 19 years ago and were based on decades-old research. The Government Accountability Office published a [2012 Report](#) that calls on the FCC to formally reassess their current RF energy (microwave) exposure limits, stating that the “FCC RF energy exposure limit *may not* reflect the latest research.” I encourage you to read scientific submissions to FCC Proceeding Number 13-84 at <http://bit.ly/1aGxQiq>. It is unknown when the FCC will make a ruling, however, *until that time* the current outdated FCC limits are *not reflective* of the current state of science.

FCC REGULATIONS DO NOT PROTECT THE PUBLIC FROM BIOLOGICAL EFFECTS

As the California Medical Association states in their [2014 Resolution](#) calling for updated FCC Regulations, “peer reviewed research has demonstrated adverse biological effects of wireless EMF [electromagnetic fields] including single and double stranded DNA breaks, creation of reactive oxygen species, immune dysfunction, cognitive processing effects, stress protein synthesis in the brain, altered brain development, sleep and memory disturbances, ADHD, abnormal behavior, sperm dysfunction, and brain tumors.”

In May 2015, over 200 scientists who have authored more than 2,000 articles on this topic appealed to the United Nations to address “the emerging public health crisis” related to cellphones and other wireless devices, urging that the United Nations Environmental Programme (UNEP) initiate an assessment of alternatives to current exposure standards and practices that could substantially lower human exposures to non-ionizing radiation. These scientists state that “the ICNIRP guidelines do not cover long-term exposure and low-intensity effects, “ and are “ insufficient to protect public health.” They also state that “the various agencies setting safety standards have failed to impose sufficient guidelines to protect the general public, particularly children who are more vulnerable to the effects of EMF.” Please see their website at <https://emfscientist.org>.

INCREASED CANCER RISK

Wireless radiofrequency radiation was classified as a Class 2B “Possible Human Carcinogen” by the World Health Organization’s International Agency for Research on Cancer in 2011. According to many scientists, evidence *has increased* since 2011, indicating that cell phone and wireless radiation should be classified as a “probable carcinogen.” Those exposed at younger ages show four to eight times increased cancer risk. [Replicated research](#) just published in Biochemical and Biophysical Research Communications indicates that radiofrequency acts as a *tumor promoter* at low to moderate levels.

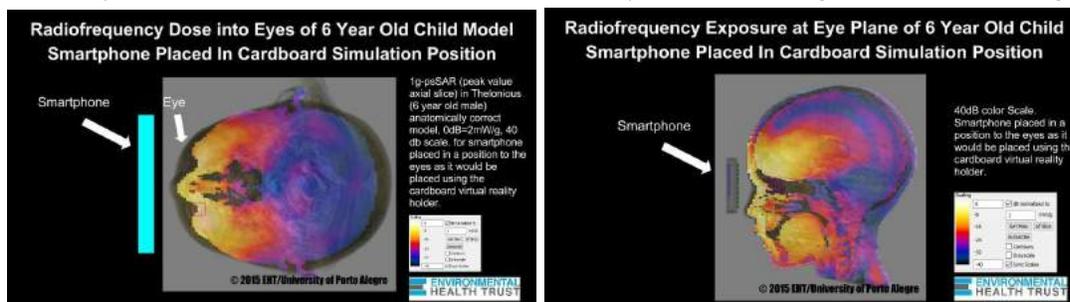
CONCERN FOR PREGNANT STUDENTS AND STAFF

Pregnant students and staff are especially at risk from wireless because the fetus is the most vulnerable to toxic exposures. Several experimental studies are showing irreversible changes after prenatal exposure to cell phone and wireless radiation such as altered brain functioning, decreased brain cells and altered reproductive organ development. More than 100 physicians, scientists and public health professionals joined together to express their concern about the risk that wireless radiation poses to pregnancy and now *urge pregnant women to limit their exposures*. Please read these scientists [BabySafe Joint Statement](#)

VIRTUAL TECHNOLOGY RESULTS IN HIGHER EXPOSURES TO THE EYE AND BRAIN

Most recently, I was contacted by a parent in your district about the virtual reality devices now used in MCPS classrooms to go on a virtual “field trip.” As indicated by online instructions, this experience involves using smartphones placed directly in front of the child’s eyes so that they can directly watch a fascinating video of faraway lands. The smartphone is streaming radiation throughout the classroom from the teacher's iPad for the entire “field trip.”

Please be aware that FCC regulations set decades ago did not utilize science that looks at the effects from cell phones on different body tissues such as the eyes. Upon hearing about this issue, I contacted EHT-associated scientists at federal universities of Brazil who do state-of-the-art computer modeling. I asked them to position the phone as it would be in the virtual reality cardboard for use in front of the child’s eyes and assess the microwave radiation. The yellow and orange color show the highest exposures.



My colleagues and I are sharing this work with you today because we believe you should have more information about microwave radiation exposures that will take place through this system.

This research image above utilizes [a sophisticated computer system](#) that the U.S. Food and Drug Administration (FDA) currently applies to evaluate medical devices. It simulates the radiation absorption into *anatomically correct models*--something that currently used systems for testing phones and devices cannot do. [In a study from Memorial Sloan-Kettering Cancer Center](#), radiation physicist David Gultekin, working with Bell Labs electrical engineer Lothar Moeller, reported that normal working cell phones can create tiny hotspots within brain tissue. Unlike other organs, [eyes](#) do not have circulation to effectively carry away heat.

In addition to the impact from the microwave radiation, there could also be impacts to a child’s retina from the blue light emitted by the screen. Youths under the age of 20, and especially very young children,

have little or no yellowing of the lens (which helps protect the adult eye). Therefore, blue light (or UV) which enters the eye is unfiltered in children and strikes the retina at full-strength exposing not only the retina, but the lens to possible damage over the long time. Such injury may not be evident until later in time.

In 2010, [Andreas Christ and team](#) reported that children's hippocampus and hypothalamus absorbs 1.6–3.1 times higher and the cerebellum absorbs 2.5 times higher microwave radiation compared to adults; children's bone marrow of the skull absorbs 10 times higher microwave radiation than in adults, *and children's eyes absorb much higher microwave radiation than adults*. A recent [Deans' Lecture](#) I delivered to University of Melbourne provides an overview on this research.

SIMPLE STEPS WILL PROTECT CHILDREN

Compelling research raises the possibility of very serious harm to children from radiofrequency radiation exposures well below “FCC compliant” levels. Legal does not mean safe. Based on the preliminary work that I share with you here, I urge you to forgo the use of such devices such as virtual reality cardboard as there is no research that has considered their impact on children’s eyes. At this time, the smart choice for school decision makers is to act now and reduce radiofrequency wireless exposures. In fact, many countries (over 20) and health authorities worldwide recommend reducing radiofrequency radiation to children.

More recently, the Cyprus Government's National Committee on Environment and Children's Health released a [video about reducing wireless](#) and I invite you to watch this excellent example of responsible action at this link <https://www.youtube.com/watch?v=H43IKNjTvRM> .

I understand that your county has a Bring Your Own Device policy whereby cell phones are not only allowed *in* the classroom but are actively used in the curriculum. As I have been told, students in film class might use their cell phones to take footage to create a movie, and in some math classes they use their cell phones as a calculator. Advice should be routinely provided to any student using a wireless device at school about *how to reduce exposures*. For example, if phones are used on airplane mode, and wireless is turned off on computers then these devices will neither send nor receive microwave radiation.

When powered on, phones undergo short bursts of microwave radiation up to 900 times per minute, *whether or not the phone is being used for talking*. Once teachers and students are educated on how they can simply turn their phone onto airplane mode, then they can use the phone in the classroom *without* being exposed to unnecessary radiofrequency radiation.

Likewise, laptops such as Chromebooks are also emitting constant radiation and at much higher levels when a student is streaming video or using cloud based applications. Laptops can easily be hardwired to ethernet so that students can safely use the internet without radiation emissions. Please review the [Best Practices for Low EMF in Schools developed by the Northeast Collaborative For High Performing Schools](#) which details how schools can reduce exposure to radiofrequency fields and still have full internet connectivity.

Along with [the recommendation](#) of over 200 scientists (see <https://emfscientist.org>) and health authorities worldwide, I recommend that the best course of action is to take simple precautions—as many nations already currently advise. *Children’s exposures to wireless radiation should be reduced as much as possible.* We have a responsibility to act now to reduce children’s exposure to radiofrequency radiation. Children’s nervous, immune and reproductive systems are rapidly developing and, along with pregnant women, children deserve an abundance of caution.

As several colleagues and I wrote in [a letter](#) to the U.S. Secretary of Education just a few months ago, we recommend your school district do the following:

1. **Raise school community awareness through new educational curriculum:** Students, teachers and their families should be given information on wireless health risks and simple precautionary steps they can take to protect their health. It is important to teach children how to use technology both safely and more responsibly in order to protect their health and wellbeing.
2. **Install a safe communication and information technology infrastructure in schools to meet educational needs:** Solutions exist to reduce exposures to wireless emissions and mitigate the health risk. Low-EMF Best Practices have been developed, allowing educational needs to be met with safer, hard-wired Internet connections, which are also faster and more secure.

Low-EMF Best Practices are the solution that allows for full communication, information access and learning tools use in the classroom while minimizing unnecessary health risks. Your district can thoughtfully integrate safe technology into every classroom while responsibly safeguarding the health of every generation.

I fully understand that this information has not been widely understood. I would be happy to provide or develop an online technical briefing to your senior staff to assist you as you make decisions today that will affect the health of students for the rest of their lives.

Yours respectfully,



Devra Davis, PhD MPH
President and Founder
Environmental Health Trust
Visiting Professor of Medicine
The Hebrew University, Hadassah Medical Center
Associate Editor, *Frontiers in Radiation and Health*
ehtrust.org



July 28, 2014

Board of Trustees
Fay School
48 Main Street
Southborough, MA 01772

Re: Advisability of WiFi in schools

Dear Sirs/Madams:

This is concerning potential adverse health effects associated with exposure to radiofrequency/microwave (RF/MW) radiation, specifically that from wireless routers and wireless computers. I am writing to express concern that students at your school are experiencing electrosensitivity symptoms from these technologies.

I am a public health physician who has been involved in issues related to electromagnetic fields (EMFs) for several decades. I served as the Executive Secretary for the New York Powerline Project in the 1980s, a program of research that showed that children living in homes with elevated magnetic fields coming from powerlines suffered from an elevated risk of developing leukemia. I served as Director of the Wadsworth Laboratory of the New York State Department of Health, as well as Dean of the School of Public Health at the University at Albany/SUNY. I have edited two books on effects of EMFs, ranging from low frequency fields to radiofrequency/ microwave radiation, or the kind emitted by WiFi routers, cell phones, neighborhood antennas and wireless computer equipment. I served as the co-editor of the BioInitiative Report 2012 (Bioinitiative.org), a comprehensive review of the literature showing biological effects at non-thermal levels of exposure, much of which has since been published in the peer-reviewed journal, *Pathophysiology* (attached). Also, I served on the President's Cancer Panel that examined radiation exposures as they relate to cancer risk, in 2009, and a report from that testimony is also attached. Thus, this is a subject which I know well, and one on which I take a public health approach rooted in the fundamental principle of the need to protect against risk of disease, even when one may not have all the information that would be desirable.

There is clear and strong evidence that intensive use of cell phones increases the risk of brain cancer, tumors of the auditory nerve and cancer of the parotid gland, the salivary gland in the cheek by the ear. The evidence for this conclusion is detailed in the attached publications. The WHO's International Agency for Research on Cancer has also classified the radiation from both cell phones and WiFi as a Class 2B "Possible Carcinogen" (2011). WiFi uses similar radio-frequency radiation as cell phones (in the 1.8 to 5.0 GHz range). The difference between a cell phone and a WiFi environment, however, is that while the cell phone is used only intermittently, and at higher power, a WiFi environment is continuous, and transmitting even when not being used. In addition, WiFi transmitters are indoors, where people (and in this case, children) may be very close by, or certainly close to devices using the WiFi, such as wireless computers, iPads and smart boards, the radiation from which can be intolerable to sensitive people.

Furthermore, commercial routers, like those in schools, operate at much higher wattage than consumer routers. They are designed to penetrate through materials like cement, wood and brick, to handle dozens to hundreds of users, and to reach into outdoor areas, so industrial grade routers are of much greater concern.

An additional consideration to appreciate is that it is not only the power of wireless radiation that causes biological dysregulation, but the frequencies, pulsing, amplitude, and the quantity and kind of information being transmitted that can have effects as well. These 'non-thermal effects' have been shown in thousands of studies to be biologically active, and may be more important than the effects from the power. Thus, while a router may be in the ceiling, or not right next to a student, teacher or administrator, the known biological and health effects, particularly the non-thermal ones, are still very much occurring.

Finally, while acute electrosensitivity symptoms, like the ones I understand your students are experiencing, are of course of great concern (such as cognitive effects impairing attention, memory, energy levels, and concentration; cardiac irregularities, including in children; or, headaches or other symptoms in students wearing braces), the full effects for society from chronic and cumulative exposures are not known at this time. Given what we do know, however, including the DNA effects, I must, as a public health physician, advise minimizing these exposures as much as possible. Indications are that cell phones and wireless technologies may turn out to be a serious public health issue, comparable to tobacco, asbestos, DDT, PCBs, pesticides and lead paint, or possibly worse given the ubiquitous nature of the exposures. While unfortunately we must wait for federal regulation to catch up with the science, the prudent thing to do in the interim would be to exercise precaution at every opportunity.

Computers and the world-wide web have tremendous value in education, but the value also depends on how these are used in numerous respects. As wired internet connections do not pose radiation risk, are readily available, are faster and more secure than WiFi, and are now even available for certain tablets, I highly recommend you factor the risks I have described into your technology planning. At the same time, I would urge you to take the complaints of your students very seriously, and potentially involve the school nurse and teachers in helping to assess the extent of the electrosensitivity problem among students at the school.

An excellent reference on the EMF and electrosensitivity science is "Electrosensitivity and Electrohypersensitivity—A Summary" (2013) authored by M.J. Bevington and available through Electrosensitivity-U.K. (www.es-uk.info/)

If I can be of further help, please do not hesitate to call.

Yours sincerely,



David O. Carpenter, M.D.
Director, Institute for Health and the Environment
University at Albany

Enclosures

Martin Blank, PhD
Department of Physiology and Cellular Biophysics
Columbia University
New York, NY 10032

July 25, 2014

Mr. Thomas McKean, President, Board of Trustees
Mr. James Shay, President-Elect, Board of Trustees
Fay School
48 Main Street
Southborough, MA01772

To the Board of Trustees,

It has been brought to my attention that school children have become symptomatic at your school after installation of WiFi. I am writing to express my concern and to encourage you to review the independent science on this matter.

I can say with conviction, in light of the science, and in particular in light of the cellular and DNA science, which has been my focus at Columbia University for several decades, putting radiating antennas in schools (and in close proximity to developing children) is an uninformed choice. Assurances that the antennas are within 'FCC guidelines' is meaningless today, given that it is now widely understood that the methodology used to assess exposure levels only accounts for one type of risk from antennas, the thermal effect from the power, not the other known risks, such as non-thermal frequencies, pulsing, signal characteristics, etc. They fail also to consider multiple simultaneous exposures from a variety of sources in the environment, and cumulative exposures over a lifetime. Compliance with FCC guidelines, thus, unfortunately, is not in any way an assurance of safety today, as the guidelines are fundamentally flawed. Until the guidelines and advisories in the U.S. are updated, the intelligent thing for your Board of Trustees to do is to exercise the Precautionary Principle and hard wire all internet connections.

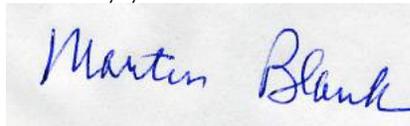
I know this might be disappointing to hear, as I understand you have invested in the WiFi. But there is no amount of money that could justify the added physiological stress from wireless antenna radiation and its many consequences, most in particular for children. Our research has shown that the cellular stress response, a protective reaction that is indicative of cellular damage, occurs at levels that are deemed 'safe'. Many other harmful reactions have been reported, such as the impairment of DNA processes that can account for the observed increased risk of cancer, as well as the potential cognitive decline, and sleep effects that may be due to impairment of the blood brain barrier. The DNA effects are of particular concern for future generations, an area of research that is just beginning to raise alarms. As with other environmental toxic exposures, children are far more vulnerable than adults, and they will have longer lifetimes of exposure.

The science showing reasons for concern about the microwave radiation emitted by antennas is abundant and there will be a day of reckoning. As I explain in my recent book,

Overpowered, The Precautionary Principle instructs us that in the face of serious threats, a lack of scientific 'certainty' never justifies inaction. The changes occurring at the molecular level, and known associations with many diseases, are sufficient at this time to give us pause and to recommend minimizing exposures to these fields, in our homes, schools, neighborhoods and workplaces. There is significant potential for risk, and to very large numbers of people, and the effects are occurring nonetheless whether or not we are noticing them.

I recommend you hardwire the internet connections at your school, and also encourage students to use hard wired connections at home for internet access, as well as for all computer equipment connections and voice communications.

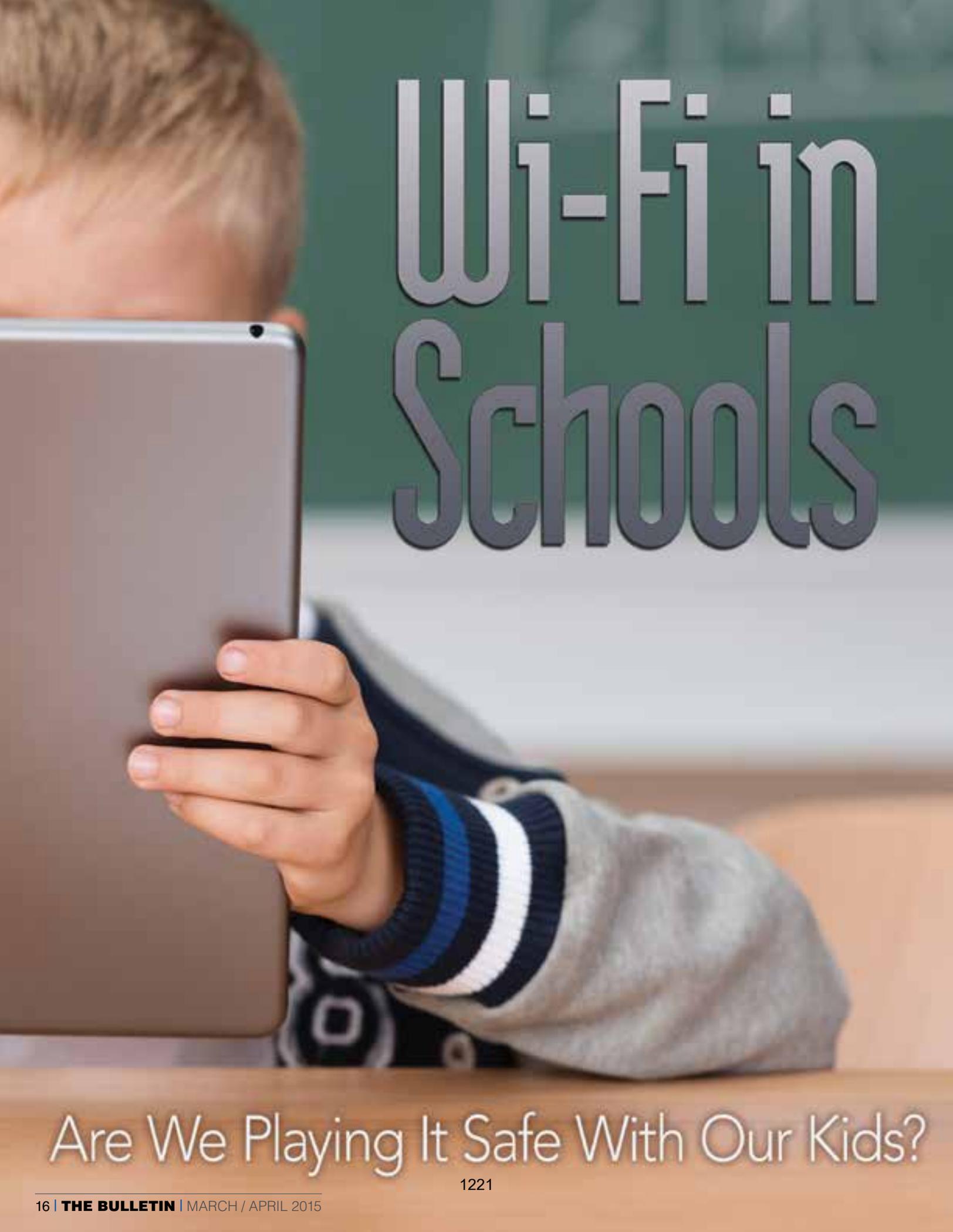
Sincerely yours,



Martin Blank, PhD
mb32@columbia.edu,



Martin Blank, PhD, Special Lecturer and (ret.) Associate Professor, Columbia University, Department of Physiology and Cellular Biophysics. Dr. Blank is a leading expert in the effects of electromagnetic fields on DNA and biology, and Past President of the Bioelectromagnetics Society. He holds two PhDs, in physical chemistry and in colloid science, an interdisciplinary field involving chemistry, physics and nanoscience. Dr. Blank was author of the BioInitiative Report's section on the impact of electromagnetic fields on Stress Proteins; Editor of the journal *Pathophysiology's* special issue on Electromagnetic Fields (2009); and co-author of "Electromagnetic fields and health: DNA based dosimetry" (2012), which recommends a new way of assessing the biological impact of electromagnetic fields across the spectrum, using DNA. Dr. Blank's book, "*Overpowered—What Science Tells Us About the Dangers of Cell Phones and Other WiFi-Age Devices*", was published in 2014.



Wi-Fi in Schools

Are We Playing It Safe With Our Kids?

“Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children. It is essential that any new standard for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded throughout their lifetimes.” American Academy of Pediatrics Letter to FCC August 29, 2013 (20)

By Cindy Russell, MD

VP of Community Health, SCCMA

Industry has been quite successful in creating magically useful wireless technologies such as cell phones, Ipads, Wi-Fi, and now wearable tech devices such as Google glasses, we all love. Many of these handy gadgets have now reached the typical classroom across the globe. It has become apparent, however, that there are substantial downsides to being too connected to technology and as safety concerns mount, governments such as France and Israel are backing away from the blind adoption of wireless technology in schools, especially for young children.

These devices are cool and convenient, however there remains nagging questions of overuse and safety as the application of these devices has increased to the point we are literally exposed 24 hours a day to this radiation. Wireless microwaves come from many sources both at work and at home.

An increasing number of physicians, scientists, and parents are concerned about long term health effects from Wi-Fi in schools. (42)(43)(44)(49) As any parent knows, computers now are as ubiquitous in schools as they are at work. From kindergarteners on up kids are required to learn computer skills in order to take core testing online. There is a push to enable students to be connected to the internet 24/7 to take photos, email documents, and research a topic. In schools, wired connections for computers have been rapidly being eliminated to install wireless systems that connect students both indoors and outdoors on campus.

Europe and some schools in the U.S. are taking a different more precautionary approach and going back to the future with wired plug in computers. Studies have also cast doubt on some of the benefits of classroom computers and warned of the new age of “Digital Dementia” which has now crept into Korean youth due to the heavy use of electronic gadgets. (17)(48)

Professors in college are banning computers during lectures and finding students learn more. (38) (39)

CHILDREN ARE MORE VULNERABLE THUS NEED MORE PROTECTION

Children have several organ systems that are immature at birth and are thus much more sensitive to toxic exposures. The human brain, one of the top vital organs, is far from being a finished product in youth. Long-term structural maturation of the nervous system is required for successful development of cognitive, motor, and sensory functions. Neuronal axons – long thin projections from the nerve cell – act as electronic transmission lines. Axons in major pathways of the brain continue to develop throughout childhood and adolescence. Myelin is the insulation surrounding individual nerves protecting it from outside electrical charges. The process of myelination is much faster the first two years but continues into adulthood. (16) Children have thinner skulls (29), their immune systems are undeveloped, their cells are dividing more rapidly, thus, they are more vulnerable to EMF radiation and other carcinogens. They also have a longer cumulative exposure to all toxins including EMF radiation.

CURRENT WIRELESS SAFETY STANDARDS AND MICROWAVING POTATOES

Wireless devices work on high frequency microwaves similar to the microwave you use to cook food with. It is with less power but substantial research (1)(2)(3)(4) demonstrates that even at low power within the current safety standards these microwaves can cause biologic harm to plants, animals, and cellular structures. Current Federal Communications Commission (FCC) standards are based only on heat generated by the device, not on adverse biological effects seen in hundreds of studies and at much lower levels.

Our own CMA supports reassessment of EMF standards. The California Medical Association, in 2014, passed a resolution as follows:

“Resolved 1: That CMA supports efforts to re-evaluate microwave safety exposure levels associated with wireless communication devices, including consideration

of adverse nonthermal biologic and health effects from non-ionizing electromagnetic radiation used in wireless communications and be it further

Resolved 2: That CMA support efforts to implement new safety limits for wireless devices to levels that do not cause human or environmental harm based on scientific research.

ADVERSE EFFECTS DEMONSTRATED IN PEER REVIEWED PUBLISHED RESEARCH (2)

- DNA with single and double stranded breaks
- Leakage of the blood brain barrier (two hours of cell phone exposure causes 7+ days of albumin leakage)
- Stress protein production in the body indicating injury
- Infertility/reproductive harm
- Neurologic harm with direct damage to brain cells
- Lowering of melatonin levels
- Immune dysfunction
- Inflammation/oxidation.

PLAUSIBLE MECHANISM FOUND FOR EMF MICROWAVE EFFECTS

Dr. Martin Pall, Professor Emeritus of Biochemistry, Washington State University has studied how electromagnetic fields impact the cells of our bodies. His 2013 paper on this subject highlights a major biological mechanism of action of EMF microwave radiation on cell structure. His work, along with two dozen prior studies, demonstrated that EMF microwave radiation effects cellular calcium channels and this can be inhibited with calcium channel blockers. "A whole series of biological changes reportedly produced by microwave exposures can now be explained in terms of this new paradigm of EMF actions via Voltage Gated Calcium Channels (VGCC) activation." (14)(15)

EMF AFFECTS ON WILDLIFE: BIRDS, BEES, AND TOMATO PLANTS

Bird researchers in Germany found that their migratory European Robins lost their sense of navigation when in the city. (5) This was found to be due to the EMF radiation interfering with the bird's special internal magnetic compass. They replicated the experiment over seven years before publishing the results in the prestigious journal *Nature*.

John Phillips and others have found that newts, sea turtles, and migratory birds use a magnetic compass to navigate long distances and this can be interrupted by low levels of EMF. (6)(7) A review of effects on cell towers and wireless devices showed that beehives can have rapid colony collapse with exposure to cell phone radiation. (8)

Plants have been shown to have stress response to EMF from wireless devices. (9)(10) (22) In tomatoes exposed for short duration, the stress response seen by exposure to EMF was prevented by administration of calcium counteracting drugs. (11) Even simple high school science experiments document abnormal seed growth near Wi-Fi routers. (19) There appear to be adverse biological effects of this seemingly harmless radiation.

HUMAN ELECTROSENSITIVITY: IS IT REAL?

There is varied opinion about those who state they are sensitive to EMF. Scientific research has not given a definitive answer, nevertheless, many seem to suffer from vague and often disabling symptoms they feel in the presence of EMF. Exposure to EMF radiation in some people reportedly causes headaches, memory problems, fatigue, sleep disorders, depression. This is so significant for some people that they have to live in a very low EMF environment to feel normal. (25)

Sweden recognizes electro-sensitivity as a functional impairment and estimates that about 3% of the population suffers from this. (23)(24) Dr. Magda Havas found in replicated studies that some EMF sensitive individuals heart rates increased with wireless devices turned on in double blind study. (12)(26) Researchers at Louisiana State University, in 2011, studied a self reported EMF sensitive physician and found "In a double-blinded EMF provocation procedure specifically designed to minimize unintentional sensory cues, the subject developed temporal pain, headache, muscle twitching, and skipped heartbeats within 100 s after initiation of EMF exposure ($p < .05$)." They concluded that "EMF hypersensitivity can occur as a bona fide environmentally inducible neurological syndrome." (27)

Genius and Lipp reviewed the current literature on EHS, in 2011, and point to several explanations for this multisystem phenomenon, including toxicant induced loss of tolerance as many with EHS symptoms had high levels of PCB's possibly causing immune dysfunction. Scientific research also identifies an inflammatory response with cytokine production. Another aspect of research points to catecholamine and adrenal gland dysfunction. In addition, heavy metal toxicity has also been proposed as contributing to EHS. (28)

The Austrian Medical Association feels Electrohypersensitivity is a real phenomenon and in 2012 published Guidelines for EMF and Electro-hypersensitivity. They state the primary method of treatment should consist in the prevention or reduction of EMF exposure, taking care to reduce or eliminate all sources of EMF if possible. (32)

In May 2011, the International Agency for Research on Cancer (IARC) classified radiofrequency electromagnetic fields as possibly carcinogenic to humans (Group 2B).(30)

GOVERNMENT ACTIONS ON WI-FI IN SCHOOLS

While much of the U.S. is marching forward with Wi-Fi in schools, Europe is changing direction, as indicated by the policies listed below. (45) Internationally there is wide disagreement in standards. The U.S. and Canadian limits are 1000 microwatts/cm². China and Russia are 10 microwatts/cm². Belgium is 2.4 microwatts/cm², and Austria is 0.001 microwatts/cm². The Bioinitiative Report 2012 recommendation for "No Observable Effect" is 0.0003 microwatts/cm². Cosmic background EMF we evolved with is <0.0000000001 microwatts/cm². (2)

COUNCIL OF EUROPE PARLIAMENT ASSEMBLY 2011 EMF MICROWAVE POLICY : "THE POTENTIAL DANGERS OF ELECTROMAGNETIC FIELDS AND THEIR EFFECT ON THE ENVIRONMENT"

The report notes "other non-ionizing frequencies, whether from ex-

tremely low frequencies, power lines or certain high frequency waves used in the fields of radar, telecommunications, and mobile telephony, appear to have more or less potentially harmful, non-thermal, biological effects on plants, insects, and animals, as well as the human body, even when exposed to levels that are below the official threshold values.”

The Council calls for a number of measures to protect humans and the environment, especially from high-frequency electromagnetic fields. One of the recommendations is to “take all reasonable measures to reduce exposure to electromagnetic fields, especially to radio frequencies from mobile phones, and particularly the exposure to children and young people who seem to be most at risk from head tumors”. (37)

IN FRANCE: A NEW NATIONAL LAW BANS WI-FI IN NURSERY SCHOOLS

In January 2015, France passed a landmark law that calls for precaution with wireless devices for children and the general public. (34)(35) It calls for:

1. Wi-Fi banned in nursery schools.
2. Wi-Fi routers should be turned off in school when not in use.
3. Schools are informed when new tech equipment is installed.
4. Citizens will have access to environmental cell tower radiation measurements near homes.
5. There will be continued research conducted into health effects of wireless communications.
6. Information on reducing exposure to EMF radiation is mandatory in the contents of the cell phone package.
7. Wi-Fi hotspots are labeled.

ISRAELI MINISTRY OF EDUCATION ISSUE GUIDELINES TO LIMIT WI-FI IN SCHOOLS

On August 27, 2013, the Israeli Ministry of Education issued new guidelines regarding Wi-Fi use in schools.

(33) The guidelines will:

1. Stop the installation of wireless networks in classrooms in kindergarten.
2. Limit the use of Wi-Fi between first and third grades. In the first grade, students will be limited to use Wi-Fi to study for one hour per day and no more than three days per week. Between the first and third grades, students will be limited to use Wi-Fi up to two hours per day for no more than four days per week.
3. To limit unnecessary exposure teachers will be required to turn off mobile phones and Wi-Fi routers when they are not in use for educational purposes.
4. All Wi-Fi equipment be tested for compliance with safety limits before and after installation in an Israeli school.
5. Desktop computers and power supplies be kept at least 20 cm from students.

2012 THE RUSSIAN COMMITTEE ON NON-IONIZING RADIATION PROTECTION



OFFICIALLY RECOMMENDED THAT WI-FI NOT BE USED IN SCHOOLS.

2011 THE RUSSIAN COMMITTEE ON NON-IONIZING RADIATION PROTECTION (RNCNIRP) RELEASED THEIR RESOLUTION ENTITLED “ELECTROMAGNETIC FIELDS FROM MOBILE PHONES: HEALTH EFFECTS ON CHILDREN AND TEENAGERS.”

According to the opinion of the Russian National Committee on Non-Ionizing Radiation Protection, the following health hazards are likely to be faced by the children mobile phone users in the nearest future: disruption of memory, decline of attention, diminishing learning and cognitive abilities, increased irritability, sleep problems, increase in sensitivity to the stress, increased epileptic readiness. (36)

Expected (possible) remote health risks: brain tumors, tumors of acoustical and vestibular nerves (in the age of 25-30 years), Alzheimer’s

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disease, “got dementia”, depressive syndrome, and the other types of degeneration of the nervous structures of the brain (in the age of 50 to 60).

PLAYING IT SAFE FOR OUR KIDS

A healthy and safe learning environment is a cornerstone of education. Current FCC standards are obsolete and inappropriate as they are based only on heat effects, not biological effects. They give us a false sense of security. There may be higher EMF levels at school than at home as routers are more powerful. Cumulative Effects on DNA or cell structures are not taken into consideration in any safety standard. Because of the long-term exposure to EMF microwave radiation this generation is experiencing, they will be at higher risk for potential health problems. We will not know what happens to our progeny’s DNA until our grandchildren are born.

Considering there has been a more precautionary approach internationally to microwave radiation exposure and the trend is toward less exposure in schools, especially to vulnerable populations such as children, it makes sense to re-evaluate our wireless schools. We buckle our seat belts and wear a helmet when we ride bikes even though we don’t know if we will get in an accident. Although not all the issues of wireless microwaves are understood, there is enough science to understand it acts as a toxicant at even low levels that fall within current safety standards. We also know

3. **Limit Wi-Fi use**, especially in younger grades.
4. **Cell phones stay off and in the backpacks during class** and on the campus during school hours.
5. **Have EMF and electrical measurements done by one or more qualified, experienced consultants before and after any installation.** Understand you may need to increase your knowledge of low and high frequency electromagnetic fields and limits to accurately interpret the reports. The Bioinitiative Report is a very useful compendium that has recommendations for safer levels.
6. **Support efforts by governments to provide independent standardized transparent research to define safe limits in all the different wireless frequencies used commercially.** This could lead to less EMF emissions and safer wireless devices.

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5. **Electronics’ noise disorients migratory birds. Man-made**

“Certain high frequency waves used in the fields of radar, telecommunications, and mobile telephony, appear to have more or less potentially harmful, non-thermal, biological effects on plants, insects, and animals, as well as the human body, even when exposed to levels that are below the official threshold values.”

that decades of research precedes meaningful regulation in the area of toxins, thus the only reasonable approach is precautionary.

In addition, we need to be thoughtful about how much our kids should use computers and what this is doing not only to them, but to our society as a whole. We get starry eyed with every new wireless gadget, however, in “Alone Together” Sherry Turkle expertly addresses the rise in isolation, loneliness, lack of privacy, and increasing pressure on students in this age of invasive technology. Her thorough and non-judgmental scientific investigation of the psychological effects of computers makes us aware that we need to take care that we do not replace real human connection with a “virtual reality” that will redirect us in an unhealthy direction.

As physicians and parents, we understand that decisions we make today may have far reaching consequences in the future for our kids. Let’s play it safe for them right now.

RECOMMENDATIONS FOR SCHOOLS

1. **Wired internet connections** like we used to have are the safest and possibly cheapest option – all the benefits of the internet without the risk.
2. **Wireless devices**, but with an on/off switch in each room so teachers can use only when needed for educational purposes.

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STEPHEN T. SINATRA M.D., F.A.C.C.

F.A.C.N., C.N.S., C.B.T.,
Integrative Metabolic Cardiology

July 16, 2014

Chairman and Trustees
Fay School
48 Main Street
Southborough, MA 01772

RE: Wi-Fi in Schools

Dear Chairman and Trustees:

I am writing this letter on behalf of concerned parents of children who are attending schools with Wi-Fi technology. I'm a cardiologist and co-founder of Doctors for Safer Schools, an organization dedicated to informing teachers, parents and superintendents about the uncertainty and possible environmental health hazards of Wi-Fi technologies.

The heart is a delicate and complex electromagnetic organ that can be adversely affected by exogenous signals from wireless technology and microwave radiation. For this reason it is unwise to expose students and teachers to Wi-Fi radiation for internet access, especially when safer alternative wired options are available. Children are particularly vulnerable to this radiation and the incidents of cardiovascular events including sudden cardiac arrest, seems to be increasing, especially among young athletes (up to the age of 19). In some cases this is due to undetected heart defects, blunt trauma to the heart in contact sports, and heat stress during strenuous exercise, but in instances these irregularities may be exacerbated by or due to microwave signals interfering with the autonomic nervous system that regulates the heart.

I know this because I am a board certified cardiologist and have been a Fellow of the American College of Cardiology since 1977. At the Manchester Memorial Hospital in Connecticut, I served in several roles, including Chief of Cardiology, Director of Cardiac Rehabilitation, and Director of Medical Education.

In both Canada and the United States a large number of students are complaining that they feel unwell in classrooms that have Wi-Fi technology. These complaints have been investigated and what emerges is the following:

1. Symptoms common among these students include headaches, dizziness, nausea, feeling faint, pulsing sensations or pressure in the head, chest pain or pressure, difficulty

concentrating, weakness, fatigue, and a racing or irregular heart accompanied by feelings of anxiety. These symptoms may seem diverse but they indicate autonomic dystonia or dysfunction of the autonomic nervous system.

2. Symptoms do not appear in parts of the school that do not have this technology (Wi-Fi-free portables) and they do not appear in homes that do not have wireless technology.

3. We know that the heart is sensitive to and can be adversely affected by the same frequency used for Wi-Fi (2.4 GHz) at levels a fraction of federal guidelines (less than 1%) and at levels that have been recorded in two Ontario schools with Wi-Fi technology.

4. The incidence of sudden cardiac arrests (SCA) among young athletes is increasing and doctors don't know why. In one small Ontario community, the number of students experiencing SCA is disturbingly high. Whether WiFi and nearby cell phone antennas exacerbate SCA needs to be investigated further before students are subjected to these fields.

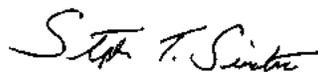
In conclusion it is unwise to install wireless technology (WiFi) in schools. We do not know what the long-term effects of low-level microwave radiation are on students and teachers. The safety of this technology on children has not been tested and I would advise that you follow the precautionary principle that states the following:

"In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."

(Rio Conference 1992).

The principle implies that we have a social responsibility to protect the public from exposure to harm, when scientific investigations have found a plausible risk. That "plausible risk" exists for microwave radiation at very low levels. These protections can be relaxed only if further scientific findings emerge that provide sound evidence that no harm will result. In some legal systems the application of the precautionary principle has been made a statutory requirement.

Sincerely,



Stephen T. Sinatra, M.D., F.A.C.C., F.A.C.N., C.N.S



Karolinska Institutet
Department of Neuroscience
Experimental Dermatology Unit

Stockholm, July 24, 2014

Mr. Thomas McKean, President, Board of Trustees
Mr. James Shay, President-Elect, Board of Trustees
Fay School
48 Main Street
Southborough, MA 01772

Ladies and Gentlemen,

It has been brought to my attention that children in your school are physically being impacted by radiation from WiFi antennas, and that some of the student's reactions have been severe. I was concerned to learn this. It is unwise to chronically expose children to this type of radiation, as their bodies are more sensitive than adults and the radiation has been shown to impair not just physiological functioning but cognitive function and learning.

Radiation of the kind emitted by WiFi transmitters impacts attention, memory, perception, learning capacity, energy, emotions and social skills. There is also diminished reaction time, decreased motor function, increased distraction, hyperactivity, and inability to focus on complex and long-term tasks. In some situations, children experience cardiac difficulties. In one Canadian school district, incidence of cardiac arrest in children was 40x the expected rate, and defibrillators have had to be placed at each school. Online time, particularly multi-tasking in young children, has been linked with a chronically distracted view of the world preventing learning critical social, emotional and relational skills. There is a physiological as well as psychological addiction taking place. I am sure, that as stewards of the lives of the children in your charge, you would not wish any of these outcomes.

Given the large and growing body of science indicating biological and health effects from the radiation emitted by antennas, it would be most imprudent at this time to permit wireless antennas on—or inside—your property. Understand the FCC exposure guidelines only protect against the acute power density, or acute thermal, effects, and they do nothing to protect against the other aspects of the radiation's risk, such the frequencies, amplitude, pulsing, intensity, polarity and biologically disruptive information content. Thus, until the FCC establishes guidelines for the non-thermal effects, any reliance by your school on current FCC guidelines, based solely on *thermal effects* would necessarily be incomplete. I urge a school of your caliber to be a leader on this issue, and appreciate that two wrongs do not make a right.

I enclose for your review the transcript of the Seletun Scientific Statement laying out the key concerns on this topic. If I can be of further help, please, do not hesitate to be in touch.

Yours truly,

Olle Johansson, Associate Professor
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CC: cheemf@lists.healthandenvironment.org

Sent: 2/8/2013 2:21:54 P.M. Pacific Standard Time

Subj: [cheemf] Adoption of Wi-Fi in Los Angeles USD classrooms

TO: Los Angeles Unified School District (LAUSD)

FROM: Joel M. Moskowitz, Ph.D.

Director, Center for Family and Community Health

School of Public Health

University of California, Berkeley

RE: Adoption of Wi-Fi in Classrooms

DATE: February 8, 2013

Based upon my review of the research of the health effects associated with exposure to radiofrequency (RF) electromagnetic radiation (EMR), especially microwave radiation, I feel compelled to register my concern that adoption of Wi-Fi in LAUSD classrooms is likely to put at risk the health of many students and employees in the District.

In December, Dr. Gayle Nicoll of URS Corporation asked me to serve as an expert reviewer for a report that URS prepared for the LAUSD regarding the adoption of Wi-Fi in classrooms. Since Ms. Nicoll could not assure me that URS has no conflicts of interest, I turned down her request and sent her references to recent studies about Wi-Fi radiation. I cc:ed Board members and key staff as I was concerned about the health risks of unnecessarily subjecting 660,000 children to 13,000 hours of Wi-Fi microwave radiation during their K-12 school years.

Although I have not seen the URS report, I imagine it is based on the FCC's outmoded 1996 safety standards which only protect the public from the **thermal risk of RF EMR exposure** (i.e., from heating of tissue). For the past three years, in numerous media interviews I have been calling on the FCC to strengthen its standards and testing procedures to protect the public and workers from the low-intensity, **non-thermal risks of RF EMR exposure** that have been reported in hundreds, if not thousands, of research studies. These include increased risk of neurological and cardiovascular problems, sperm damage and male infertility, reproductive health risks, and cancer.

The **precautionary principle** should be applied to this critical policy decision. This principle, developed at a U.N. environmental conference in 1992 states that in the absence of scientific consensus if an action has a suspected risk of causing harm, the burden of proof it is not harmful falls on those taking the action, and all reasonable measures to reduce the risk must be taken.

Internet access can be provided to students through wires or optical fiber without installing Wi-Fi in the classrooms.

For further information, please see my **Electromagnetic Radiation Safety web site** at <http://saferemr.blogspot.com> where I have archived news releases and links to recent reports by major scientific groups and political agencies.

Sincerely,

Joel M. Moskowitz, Ph.D.

=====

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EMR Safety Web Site: <http://saferemr.blogspot.com>

December 1, 2015

Montgomery County Schools
Carver Educational Services Center
850 Hungerford Drive
Rockville, MD 20850

Attention: Dr. Andrew Zuckerman, Chief Operating Officer
MCPS Board of Education Members

This letter of comment has been prepared after reviewing the *Montgomery County Public Schools Radiofrequency (RF) Summary Monitoring Report* dated July 2015 produced by AECOM Environment.

1) The instrument cited as being used for the peak measurements in section 7, a Narda SRM-3006, is not suitable to measure the very short (1 millisecond) spikes typically found in WiFi 802.11n communication. As stated on page 7-1, each data sweep takes 550 milliseconds, making the instrument unsuitable for reliably logging the short bursts typical in 802.11n WiFi communications. Palit et al conclude that 50% of the uplink traffic will be in bursts shorter than 2 milliseconds. The peak levels of those packets will not be reliably logged by a device with a 550 millisecond sweep time.

Palit et al, 2012. Anatomy of WiFi Access Traffic of Smartphones and Implications for Energy Saving Techniques. International Journal of Energy, Information and Communications, Vol. 3, Issue 1.

2) Even the average-level tests seem inconsistent with engineering reality. Figure 7.1 shows a background noise level mostly flat between 2.4GHz and 5.8Ghz. That noise (typically -70dBm) is generally consistent with the internal thermal noise in a quality wide-band measuring instrument. Two tiny peaks out of that noise are represented to be the "average electric field generated at one foot away from an AP in use at Beverly Farms Elementary School." Even with just the 802.11n beacon-frame idling, the peak field a foot away from an access point should be a million times higher than the levels of figure 7.1. Why do we just see a blip on the chart? Clearly some unusual 'averaging' has occurred, yet the parameters of that averaging, and the potential clinical implications of that averaging, are not noted in the annotation to the Figures. Further, Figure 7.2 shows a background noise level some 10dB higher than figure 7.1, something that would be very unusual in measurements at these Gigahertz frequencies.

3) The RF exposure estimates are additionally inadequate because, in reality, there is no way to meet the distancing that AECOM's report bases its measurements on for an individual student. In normal use, kids hover over devices. They hug them to the body. They put them in their laps at lunchtime, on the couch and in bed doing homework. It is entirely unrealistic to expect teachers and parents to guarantee that students always keep their Chromebooks at some arbitrary distance during use.

4) The report concludes with classroom RF measurement comparisons to an outdated 2007 BioInitiative Report recommendation of 0.1 uW/cm². (Section 7). Graphics need to be re-drawn with comparisons to the 2012 recommended BioInitiative level, and do so not only for a 12” spacing, but also for the one-inch distance measured from the Chromebook (Figure 7-3 and 7-4). Using an arbitrary 12” distance to report and compare to either the 2007 or 2012 BioInitiative recommendations will seriously underestimate RF exposures since students don’t always (or even typically) maintain a foot of distance. Their ‘leaning in’ and having to place their faces close to the device is common usage, and is unavoidable.

5) The methodology is not specific as to the number of operating devices and clustering of students at work – which is necessary to characterize exposures from a room full of operational wireless devices. Figure 2.1 shows multiple wireless devices connected to one wireless router. Measuring one or several Chromebooks rather than one Chromebook for each of the 25-35 students plus router isn’t how a normal classroom operates. **It does not** produce RF measurements of a typical class using many wireless devices at once, so this is a fundamental flaw. It will underestimate RF exposures.

6) There is also a comment to be made here about the setup – how does this methodology reasonably reflect how smaller or younger children with short arms and torsos actually use tablets? What RF exposures they can expect to receive? The likely consequence to the measurements is greater exposure. Unless the students are using chopsticks instead of their fingers, or are using wired keyboards that increase the distance to the wireless device, RF exposures will be worse for the younger or smaller-stature students.

7) This Report appears to legitimize MCSD’s use of wireless in the classroom by asserting compliance with the 2007 BioInitiative Report recommendation, yet the report does not mention the significant revision of that threshold in the years between 2007 and 2012. Both BioInitiative Reports clearly state that their recommendations are interim and ‘that they may have to go lower.’ Recent studies of students reporting headache, irritability, concentration and behavior problems at levels as low as 0.003-0.006 uW/cm², indicate that neither BioInitiative Report threshold may be low enough to assure safety. As the co-editor of the BioInitiative Reports, and a founding member of the BioInitiative Working Group, the way in which our work has been invoked is not consistent with the findings of the BioInitiative Reports overall. The conclusions of this report cannot be said to give a positive assertion of safety because of the degree of uncertainty over whether the testing equipment was adequate (we believe it was not); the lack of comparison data; and the failure to measure RF exposures at realistic distances from the student(s).

8) Correct BioInitiative citations are:

BioInitiative Working Group, Cindy Sage and David O. Carpenter, Editors. BioInitiative Report: A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Radiation at

www.bioinitiative.org, December 31, 2012.

BioInitiative Working Group, Cindy Sage and David O. Carpenter, Editors. BioInitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields (ELF and RF) at www.bioinitiative.org, August 31, 2007

CONCLUSION

The data in this report cannot therefore be used to infer safety, or lack of safety, of children in any of the tested locations.

Respectfully submitted,

Cindy Sage, MA
Sage Associates
Co-Editor, BioInitiative 2007 and 2012 Reports
sage@silcom.com

Prof. Trevor Marshall, PhD
Director, Autoimmunity Research Foundation,
Senior Member IEEE,
Founding chair (retired) IEEE EMBS (Buenaventura Chapter)
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International Expert Council, Community of Practice: Preventative Medicine (Moscow)
trevor.m@trevormarshall.com



September 22, 2014

On behalf of the BioInitiative Working Group, we are writing to express our concern about the views expressed by CEOs from Google, Dell, Apple, Adobe, eBay, Facebook, the George Lucas Educational Foundation and others to the FCC supporting wireless technologies in schools.

Your letter to the FCC dated July 7, 2014 titled Education Superhighway, states:

“Today, we are writing to you to urge swift bi-partisan action at your July 11, 2014 meeting to adopt the E-Rate modernization proposal set forth by Chairman Wheeler.”
“By responsibly investing \$2 billion of unused funds and providing predictable ongoing support for Wi-Fi, the plan will make dramatic progress in bringing high-speed connectivity to our classrooms.”

No one denies that bringing high-speed connectivity to our classrooms is important. But it can be a wired connection and does not have to be WiFi. It does not reflect well on the ethics of your corporations to encourage the FCC to provide \$2 billion dollars for new wireless classroom infrastructure and devices for school children, knowing that wireless emissions have been classified as a Possible Human Carcinogen by the World Health Organization’s International Agency for Research on Cancer (2011). To promote wireless technologies in schools is to deliberately and knowingly disregard current health warnings from international science and public health experts.

Saturating schools with wireless technology will likely create unnecessary liability for municipalities and result in a loss of public trust and confidence in the corporations that push their wireless products with a blind eye toward health concerns.

Epidemiological studies show links between radiofrequency radiation (RFR) exposure and cancers, neurological disorders, hormonal changes, symptoms of electrical hypersensitivity (EHS) and more. Laboratory studies show that RFR exposure increases risk of cancer, abnormal sperm, learning and memory deficits, and heart irregularities. Fetal exposures in both animal and human studies result in altered brain development in the young offspring, with disruption in learning, memory and behavior. The brain development of a fetus can be impaired by in-utero exposure to a pregnant woman. The evidence for these statements is based on hundreds of published, peer-reviewed scientific studies that report adverse effects at levels much lower than current FCC public safety limits. WiFi in schools, in contrast to wired internet connections, will increase risk of neurologic impairment and long-term risk of cancer in students. Corporations cannot avoid responsibility simply by asserting compliance with existing legal, but outdated and inadequate FCC public safety limits.

Today, corporations that deal with educational technology should be looking forward and helping school administrators and municipal leaders to access safe, wired solutions. Your corporations can reasonably foresee and offer alternatives to potentially hazardous exposures to wireless radiation by choosing to support wired educational technologies.



Thank you for your attention to this letter.

Cindy Sage, MA, Tel: (805) 969-0557 Email: sage@silcom.com
David O. Carpenter, MD, Tel: 518-525-2660 Email: dcarpenter@albany.edu
Co-Editors, BioInitiative 2012 Report
For the BioInitiative Working Group

Copies: CEOs signing Education Superhighway letter to the FCC
Federal Communications Commission
The White House, President Obama
US Secretary of Education Secretary Arne Duncan

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May 13, 2013

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Open Letter to the Superintendents
of the School Districts of the United States

The American Academy of Environmental Medicine (AAEM) strongly supports the use of wired Internet connections.

The AAEM comprises Medical Doctors, Osteopaths, and PhD researchers focusing on the effects of environmental agents on human health. For forty years the Academy has trained Physicians to treat the most difficult patients who are often overlooked by our medical system, because the cause of their illness, rather than being caused by an infection or traditionally understood cause, is related to more basic underlying causes such as chemical, toxic metal, food or radiation exposures.

In May 2011 the World Health Organization elevated exposure to wireless radiation, including WiFi, into the Class 2b list of Carcinogens.

There is consistent emerging science that shows people, especially children who are more vulnerable due to developing brains, and thinner skulls, are affected by the increasing exposure to wireless radiation. In September 2010, the Journal of the American Society for Reproductive Medicine-Fertility and Sterility, reported that only four hours of exposure to a standard laptop using WiFi caused DNA damage to human sperm.

In December 2012 the American Academy of Pediatrics- representing 60,000 pediatricians, wrote to Congress requesting it update the safety levels of microwave radiation exposure especially for children and pregnant women.

In a school setting, children are exposed to WiFi for an unprecedented period of time, for their entire childhood. Some of these signals will be much more powerful than is received at home, due to the need for the signals to go through walls, and serve multiple computers simultaneously. The school signals are dozens of times more powerful than the café and restaurant systems.

To install this system in your school district risks a widespread public health hazard that the medical system is not yet prepared to address. Statistics show that you can expect to see an immediate reaction in 3% and delayed effects in 30%, including teachers.

It is better to exercise caution and substitute with a safe alternate such as a wired connection, which is not classified as a possible Carcinogen. While more research is being conducted children must be protected. Wired technology is not only safer, it also stronger and more secure.

While the debate ensues about the dangers of WiFi, cell phone towers and cell phones, it is the doctors who must deal with the after affects. Until we can determine why some get sick and others do not, and some are debilitated for indeterminate amounts of time, we implore you to not take the risk, with the health of so many children who have entrusted you to keep them safe while at school.

Respectfully,

The Executive Committee of the American Academy of Environmental Medicine

Message to Schools and Colleges about Wireless Devices and Health

If wireless devices, such as Wi-Fi, are used in your schools and colleges, then the health of your students, your faculty, and your staff can be at risk. This is a difficult problem but an addressable one if you act.

Background: Wireless devices transmit information using radiofrequency/microwave radiation. The international biomedical research community has been studying the biological impact of such radiation for decades, but more intensely in recent years. Thousands of peer-reviewed studies published in biomedical research journals have contributed to our understanding of this impact. So many serious biological effects have been found that immediate responsive action is warranted. Further, these biological effects are occurring at levels of radiation far lower than earlier understood. Simply stated, a worldwide health crisis is emerging and is becoming a hallmark of the 21st Century. The international biomedical research community is trying to warn us; but we, in the USA, are not yet listening. I hope this message will help to change that.

As a scientist, I urge you to look into the **health impact of the radiofrequency/microwave radiation** produced by wireless devices. Examples of wireless devices of concern in our environment are Wi-Fi in all of its forms; cell phones and cell towers (especially those located on school grounds); cordless phones; wireless computers, whether desktop, laptop, or tablet versions; wireless baby monitors; wireless smart electricity meters; emerging wireless smart appliances; and microwave ovens (because they always leak radiation).

This crisis is the consequence of many factors. Here are some of them:

- All living things are bioelectrical in nature. That is why electrocardiograms and electroencephalograms work. They, of course, measure the tiny electrical signals that operate the heart and the brain. The critical tasks performed by these tiny electrical signals, and so many other electrical signals in all living things, can be disrupted by radiofrequency/microwave radiation.
- The levels of manmade radiofrequency/microwave radiation in our environment are increasing exponentially and already exceed, by many orders of magnitude, the levels at which all life on Earth evolved. Simply stated, we are drowning in a rising sea of manmade radiofrequency/microwave radiation.
- The invisible nature of radiofrequency/microwave radiation leaves the public and the decision-makers unaware of the rising levels of radiation around them.
- The genuine usefulness of wireless devices promotes denial of the risks.
- The intense advertising, the economic power, and the political power of profitable wireless industries enable them to dominate the public dialogue and to hold sway over government regulators and legislators.
- Current Federal standards for limiting the exposure of the public to radiofrequency/microwave radiation are outdated and overly permissive. Those standards are based on thermal heating alone. In effect, the Government claims that if you are not cooked too much by the radiation, then you are fine. Those Federal standards ignore the many biological effects that occur at much lower levels of radiation, leaving the public unprotected.
- Federal and state governments are advocating unlimited expansion of wireless technology, and are even co-funding such expansion and mandating the acceptance of wireless technology by the public. Such

actions reflect a widespread lack of understanding of, or willful blindness to, the underlying science and its consequences for public health.

- Some of the more serious consequences of exposure to radiofrequency/microwave radiation (such as DNA damage, cancer, and infertility) are especially nefarious because they give no early warning signs.
- Other consequences of exposure do give early warning signs (such as sleep disruption, headaches, fatigue, ringing in the ears, memory loss, dizziness, heart arrhythmia, and many others); but those signs are too often dismissed because they can have other causes as well, complicating identification of the true cause.
- The absence of routine training of physicians in the biological effects of radiofrequency/microwave radiation makes it difficult for physicians to identify the causes and to provide responsive guidance.
- Even aware individuals cannot control their exposure in any environment shared with others, because the radiation around them, much like second-hand smoke, is forced on them by unaware individuals. Only governments can fully solve this problem, but they are currently part of the problem. For now the public will have to protect itself, and that will require public education and action.

Fortunately, many of the services that wireless devices offer can be realized with much safer wired devices. The wired devices achieve connectivity with fiber-optic, coaxial, or Ethernet cables. The wired devices are faster, more reliable, and more cyber secure. They are, however, less mobile, often less convenient, and somewhat more expensive to install. But those drawbacks pale in comparison to the benefits of good health.

Simply stated, schools and colleges can protect their students, staff, and faculty from the health risks posed by wireless devices, including Wi-Fi, by converting to safe wired connectivity. If your institution lacks the resources to convert now, do consider shutting down your wireless devices anyway and converting as soon as you can. You can advance learning without leaving a trail of illness behind you, some of which can be lifelong.

As a suggested starting place for exploring the concerns about the radiation from wireless devices, I have appended an “Annotated List of References” and an “Annotated List of Videos”. Please view, especially, video (1) called “Wi-Fi in Schools, the Facts”, made in Australia, on page 6.

Regards,

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Email: ronpowell@verizon.net

My background

I am a retired U.S. Government scientist (Ph.D., Applied Physics, Harvard University, 1975). During my Government career, I worked for the Executive Office of the President, the National Science Foundation, and the National Institute of Standards and Technology. For those organizations, respectively, I addressed Federal research and development program evaluation, energy policy research, and measurement development in support of the electronics and electrical-equipment industries and the biomedical research community. I currently interact with other scientists and with physicians around the world on the impact of the environment – including the radiofrequency/microwave environment – on human health.

ANNOTATED LIST OF REFERENCES

The international biomedical research community has conducted thousands of studies seeking to identify the biological effects of exposure to both low frequency and radiofrequency electromagnetic fields, extending into the microwave region. So many serious biological effects have been found from such fields, at levels earlier thought to be low enough to be safe, that immediate action is needed to alert and protect the public.

The most massive review of this biomedical literature is the 1479-page BioInitiative 2012 Report which considered about **1800** biomedical research publications, most issued in the previous five years. The BioInitiative 2012 Report was prepared by an international body of 29 experts, heavy in Ph.D.s and M.D.s, from 10 countries, including the USA which contributed the most experts (10). The review concludes that "The continued rollout of wireless technologies and devices puts global public health at risk from unrestricted wireless commerce unless new, and far lower[,] exposure limits and strong precautionary warnings for their use are implemented."

BioInitiative Working Group, Cindy Sage, M.A. and David O. Carpenter, M.D., Editors, BioInitiative Report: A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Radiation, December 31, 2012

<http://www.bioinitiative.org>

A group of six doctors in Oregon, led by Paul Dart, M.D., released, in June 2013, a 74-page review of **279** biomedical research publications. This review makes the health case against "cell phones, base stations, Wi-Fi, Smart Meters and other RF [*radiofrequency*] or ELF [*extremely low frequency*] -emitting devices". The review notes that "The current levels of exposure need to be reduced rather than increased further. The FCC [*Federal Communications Commission*] must especially protect vulnerable groups in the population including children and teenagers, pregnant women, men of reproductive age, individuals with compromised immune systems, seniors, and workers." This review is posted on the website of the FCC at the link entitled "Health Effects of RF - Research Review (87)".

Biological and Health Effects of Microwave Radio Frequency Transmissions, A Review of the Research Literature, A Report to the Staff and Directors of the Eugene Water and Electric Board, June 4, 2013

<http://apps.fcc.gov/ecfs/comment/view?id=6017465430>

Michael Bevington, in 2013, published a book that summarizes the findings of **1828** international biomedical research publications. The book describes the symptoms caused by exposure to electromagnetic radiation, the many diseases associated with such exposure, and the relative risk levels associated with specific sources of electromagnetic radiation. The citations of papers include the PMID index numbers for easy location on the PubMed.gov website of the National Institutes of Health. This website provides the largest index to the biomedical research literature in the world.

Electromagnetic Sensitivity and Electromagnetic Hypersensitivity: A Summary by Michael Bevington
NEW EDITION: March 2013

<http://www.es-uk.info>

About 200 scientists from 39 countries around the world submitted an international appeal to the United Nations and to the World Health Organization in May 2015. These scientists seek improved protection of the public from harm from the radiation produced by many wireless sources, including "cellular and cordless phones and their base stations, Wi-Fi, broadcast antennas, smart meters, and baby monitors" among others.

Together, these scientists have published over 2000 peer-reviewed research papers on this subject.

<https://www.emfscientist.org/index.php/emf-scientist-appeal>

The International Agency for Research on Cancer, of the World Health Organization, has already classified radiofrequency electromagnetic fields as a Class 2B carcinogen ("possible carcinogen"), based primarily on the increased risk of brain cancer. That decision was made in 2011. Since then, the research supporting a higher classification of risk ("probable carcinogen", or even "known carcinogen") has continued to build.

http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf

The American Academy of Environmental Medicine (AAEM), which trains physicians in preparation for Board Certification in Environmental Medicine, states: "The AAEM strongly supports the use of wired Internet connections, and encourages avoidance of radiofrequency such as from WiFi, cellular and mobile phones and towers, and 'smart meters'." AAEM further states that "The peer reviewed, scientific literature demonstrates the correlation between RF [*radiofrequency*] exposure and neurological, cardiac, and pulmonary disease as well as reproductive and developmental disorders, immune dysfunction, cancer and other health conditions. The evidence is irrefutable." The AAEM concludes: "To install WiFi in schools plus public spaces risks a widespread public health hazard that the medical system is not yet prepared to address."

AAEM, Wireless Radiofrequency Radiation in Schools, November 14, 2013

<http://www.aaemonline.org/pdf/WiredSchools.pdf>

The American Academy of Pediatrics (AAP), whose 60,000 doctors care for our children, supports the development of more restrictive standards for radiofrequency radiation exposure that would better protect the public, particularly the children. The AAP, in a letter to the Federal Communications Commission (FCC) and the Food and Drug Administration (FDA), dated August 29, 2013, states that "Children are not little adults and are disproportionately impacted by all environmental exposures, including cell phone radiation. Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children. It is essential that any new standard for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded throughout their lifetimes."

<http://apps.fcc.gov/ecfs/document/view?id=7520941318>

The U.S. Government bears a major responsibility for the exponential growth in the levels of radiation from wireless devices in the environment. In 1996, the U.S. Congress passed, and the President signed, the Telecommunications Act of 1996. Under pressure from the cell phone industries, this law included this provision: "No State or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities [*cell towers*] on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the [*Federal Communications*] Commission's regulations concerning such emissions." Because the Federal Communications Commission's regulations on radiation exposure are so permissive, this provision prevents state and local governments from protecting their people from radiation from cell towers, based on health concerns.

Telecommunications Act of 1996

<https://transition.fcc.gov/Reports/tcom1996.pdf>

The Federal Communications Commission (FCC) has acted in partnership with the wireless industries by permitting wireless radiation levels far higher than the biomedical research literature indicates are necessary to protect human health. The success of the wireless industries in capturing the FCC, the committees in the U.S. Congress that oversee the FCC, and the Executive Branch is detailed in a new monograph from the Center for Ethics at Harvard University. As an example of that capture, the President recently appointed, as head of the FCC, the former head of the CTIA – The Wireless Association, which is the major lobbying organization for the wireless industry. This, of course, is the infamous "revolving door".

Norm Alster, *Captured Agency: How the Federal Communications Commission is Dominated by the Industries It Presumably Regulates* (2015)

<http://ethics.harvard.edu/news/new-e-books-edmond-j-safra-research-lab>

Further, the U.S. Government's "American Recovery and Investment Act of 2009" provided funding that was used to motivate the installation of wireless smart meters (also called the "Advanced Metering Infrastructure" or "AMI") by offering cost sharing, in the form of grants, to the utilities that would adopt such meters.

https://www.smartgrid.gov/recovery_act/overview/smart_grid_investment_grant_program.html

Many states then extended the impact of the above Act by *mandating* the acceptance of wireless smart meters by the public. These meters contain microwave transmitters/receivers and are placed either on, or inside, every home and many businesses. A California court-ordered document indicates that each smart meter broadcasts bursts of radiation, on average about 10,000 times per day and up to a maximum of about 190,000 times per day. Such bursts flood neighborhoods with radiation, day and night, throughout the year.

http://emfsafetynetwork.org/wp-content/uploads/2011/11/PGERFDataOpt-outalternatives_11-1-11-3pm.pdf

Increasingly, the public is becoming aware of the threat that wireless radiation poses to health. The initial opposition focuses primarily on *mandated* sources of exposure, especially when the individuals exposed include the unborn and young children as they are among the most vulnerable. Thus, the strongest initial opposition is surfacing for cell towers, especially on school grounds; for Wi-Fi in schools and colleges; and for wireless smart meters placed on, or inside, homes and businesses. Most states now have opposition groups, and some states have even 10 or 20 such groups. These groups are pursuing relief through state regulatory bodies, through state legislatures, and through the courts. Below is a sampling of the hundreds of U.S. websites that reflect the nature and scope of the opposition to the unbridled expansion of wireless technology. Such websites seek to educate the public and decision-makers, and thus to promote responsive action, based on the underlying science.

The BabySafe Project

<http://www.babysafeproject.org/the-science/>

National Association for Children and Safe Technology

<http://www.nacst.org/>

Stop Smart Meter's listing of groups in the USA and other countries opposed to wireless smart meters

<http://stopsmartmeters.org/frequently-asked-questions/contacts-database/>

Smart Grid Awareness, a Website by SkyVision Solutions, Consumer Protection Advocate

<http://smartgridawareness.org>

ANNOTATED LIST OF VIDEOS

There are hundreds of videos on the Internet that address the impact of wireless radiation on health. Here are just a few that provide an especially good introduction to this topic. An Internet search will surface many more.

(1) An introduction to the health risks posed by Wi-Fi in schools

Wi-Fi in Schools, the Facts (September 9, 2013) (18 minutes)

Produced by Wi-Fi in Schools Australia.

<https://www.youtube.com/watch?v=QQryZbxlgXI&feature=youtu.be>

(2) Wide ranging overview of the impact of electromagnetic radiation on human health, particularly at microwave frequencies, with a special emphasis on children and the school environment

Electromagnetic Radiation Health for Children 2014 (70 minutes)

Presented by Dr. Erica Mallery-Blythe, a UK physician.

<https://www.youtube.com/watch?v=sNFdZVeXw7M>

(3) Documentary on the wireless industry's efforts to suppress public awareness of the health effects of wireless radiation

Microwaves, Science & Lies (2014) (90 minutes)

Produced by Jean Heches and Nancy de Meritens of France.

<https://vimeo.com/ondemand/17755/89417454>

(4) Samples of video testimony by individuals harmed by the radiation from wireless devices

Cell Phones Cause Cancer (October 17, 2012) (9 minutes)

Presented by Jimmy Gonzalez, Esq.

<https://www.youtube.com/watch?v=DII0VJd0IA8>

Woman suffers acute radiation exposure from a bank of smart meters (January 21, 2015) (3 minutes).

Produced by Maryland Smart Meter Awareness.

<https://www.youtube.com/watch?v=F9QZuWPw6Y0&feature=youtu.be>

Man experiences adverse health effects from exposure to a smart meter (March 7, 2013) (3 minutes).

Presented by Garic Schoen of Gaithersburg, MD.

Produced by Maryland Smart Meter Awareness.

<http://marylandsmartmeterawareness.org/smart-meter-news/maryland-ms-resident-testimony-to-economic-matters-committee-re-hb1038-on-march-14-2013/>

Individuals with high sensitivity to the radiation from wireless devices search for increasingly rare safe electromagnetic environments.

Searching for a Golden Cage (May 8, 2014) (13 minutes)

Produced by Nadav Neuhaus.

<http://time.com/golden-cage/>

Patrons:

Prof. Declan Kennedy
Prof. Vyvyan Howard
Prof. Risteard Mulcahy



7th January, 2013

Dear Principal,

The Irish Doctors Environmental Association (IDEA) has very serious concerns in relation to the ubiquitous use of Wi-Fi in Irish schools, and alerts you to the warnings of many leading international scientists and medical doctors who believe Wi-Fi is harmful to health, especially children's health.

<http://wifiinschools.org.uk/resources/safeschools2012.pdf>

Wi-Fi is an unregulated technology and there is absolutely no evidence that it is safe.

Since May 31st, 2011, radiofrequency electromagnetic fields (as in Wi-Fi) have been classified by the World Health Organisation as 'possibly carcinogenic' to humans. The IDEA unequivocally supports the Council of Europe, The European Environmental Agency and The International Commission for Electromagnetic Safety (ICEMS) in urging the adoption of the Precautionary Principle to protect human health.

Warnings by Scientists and Doctors:

<http://www.iemfa.org/index.php/appeals>

The Precautionary Principle has already been adopted by a number of Governments and agencies internationally.

Governments & organisations banning and warning against Wi-Fi:

http://www.cellphonetaskforce.org/?page_id128

While we fully support the promotion of technology in education we urge you to use wired technologies for your own safety and that of your pupils and staff. The tragedy of avoidable illness is only superseded by the knowledge that it could have been avoided.

Yours sincerely

Elizabeth Cullen M.B. B.Ch. B.A.O. M.Sc. Ph. D

045-485215

Philip Michael M.B. B.Ch. B.A.O. D.C.H. MICGP

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Affiliated to: ISDE -
International Society of
Doctors for the Environment.
www.isde.org
and members of HEAL -
Health and Environment Alliance
www.env-health.org
and HCWH -
Health Care Without Harm.
www.noharm.org

Linked officially with WHO -
World Health Organisation

Affiliated to International
Physicians for the Prevention
of Nuclear War - IPPNW
(Nobel Prize Winner 1985)

Charity No. 14368

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April 9, 2014

Via email: rec@harlanglaw.dk

Dear members of The Committee on Radiation Protection/Komitéen for Strålebeskyttelse:

My name is Frank Clegg and I am the CEO of Canadians for Safe Technology, C4ST, a volunteer based, national organization which promotes the safe use of wireless technology.

In my previous role as President of Microsoft Canada, I witnessed the incredible benefits that technology can provide. I also witnessed the potential harmful effects if technology is not implemented safely. Though wireless technologies afford schools various advantages, this solution cannot overshadow the evidence which demonstrates cause for concern. I request that you consider the following important facts.

The Canadian Teachers' Federation (CTF) is a national alliance of provincial and territorial teacher organizations that represent nearly 200,000 elementary and secondary school teachers across Canada. In their submission to the public consultation of the Royal Society of Canada, Oct. 28, 2013, they submitted the following recommendations. (Safety Code 6 is Health Canada's guideline regarding the limits of radiation from wireless devices).

Recommendations...

... That Safety Code 6 include a recommendation for prudent use of Wi-Fi whenever possible including the recommendation to limit consistent exposure in schools by turning off wireless access points when not in use. ...

That Safety Code 6 exposure thresholds be based upon both thermal and biological effects of exposure to Wi-Fi.

... That the Expert Panel recommend an education program regarding the relative safety of Wi-Fi exposure and that appropriate resources be developed to educate the public regarding ways to avoid potential exposure risks of Wi-Fi access points and devices.

As reported by CBC News on Aug. 17, 2013, <http://www.cbc.ca/news/canada/toronto/story/2013/08/17/toronto-cell-phone-ban.html> "The Elementary Teachers' Federation of Ontario has updated its policy position on the student use of personal electronic devices, preferring for them to be turned off and put away unless a teacher says otherwise. That policy, which was amended at the union's annual general meeting, informs ETFO in its discussions with the government and school boards on related issues. A portion of that policy now states that such devices, which include cellphones, should "be stored and turned off during the instructional day unless their use is directly authorized by staff." In a separate resolution, ETFO voted to study the effects of non-ionizing electromagnetic radiation, the potentially harmful radiation emitted by cellphones. A report is due on the matter in February."

In a letter to the Peel Region, April 22, 2013, The American Academy of Environmental Medicine stated "To install this widespread wireless internet access system in Peel District schools risks a widespread public health hazard that the medical system is not yet prepared to address. Statistics show that you can expect to see an immediate reaction in 3% and delayed effects in 30%, including teachers."

In 2012, the BC Confederation of Parent Advisory Councils passed resolution 18 which states: "BCCPAC call on Boards of Education to cease to install Wi-Fi and other wireless networks in schools where other networking technology is feasible."
<http://www.bccpac.bc.ca/resolutions/wi-fi-classrooms-committee-report>

In May 2011, the World Health Organization (WHO) announced that the radiation emitted from wireless devices, including Wi-Fi, is a Class 2B carcinogen, which falls into the same category as lead and DDT.

You may already be aware that some schools and libraries in France and Switzerland have already removed Wi-Fi due to the suspected harmful health effects.

The Council of Europe, which includes 47 countries, adopted resolution 1815 which suggests in member countries "give preference to wired Internet connections, and strictly regulate(s) the use of mobile phones by schoolchildren on school premises."

The European Parliament (EU) resolutions 2008/2211(INI) & 2007/2252(INI,) state: "wireless technology (mobile phones, Wi-Fi / WiMAX, Bluetooth, DECT landline telephones) emits EMFs that may have adverse effects on human health... particularly to young people whose brains are still developing... **the limits on exposure to electromagnetic fields which have been set for the general public are obsolete.**" (emphasis in original)

Other countries such as Israel, Russia, Switzerland, Frankfurt, Bavaria, and Salzburg have followed suit making the difficult decision to use hard wired connections as well. Recently, France passed a law recommending hard wired technology in schools.

The Austrian Medical Chamber shares that “WiFi may lead to concentration difficulties and memory problems in certain individuals.” The Austrian Medical Association recommends Wi-Fi free school environments.

The International Society of Doctors for the Environment (ISDE) and Irish Doctors Environmental Association (IDEA) advises to “Avoid Wi-Fi in home or work if possible, particularly in schools or hospitals. Use wired technology whenever possible” sharing that: “Because of the potentially increased risks for the fetus, infants and young children due to their thinner more permeable skulls and developing systems, particularly the immune and neurological systems, based on the precautionary principal and on the mounting evidence for harm at the sub-cellular level, we recommend that EMR exposure should be kept to a minimum.”

The American Academy of Pediatrics (AAP) - 60,000 Pediatricians and Pediatric Surgeons calls for caution as well stating that “The differences in bone density and the amount of fluid in a child’s brain compared to an adult’s brain could allow children to absorb greater quantities of RF energy deeper into their brains than adults... the current exposure limits may not reflect the latest research on RF energy” and lends support to removing Wi-Fi from schools as well.

As stewards of the public trust, I urge you to ensure the safest possible learning environment for the students in your care and to set an example for school districts by removing Wi-Fi and adopting “Best Practices” which limit the use of other wireless technologies.

Sincerely,



Frank Clegg
CEO,
Canadians for Safe Technology (C4ST)
frank@c4st.org

cc: Susanne Hansen, sh.klodskov@gmail.com

28 February 2011

Chairman and Trustees
Kawartha Pine Ridge District School Board
Education Centre
1994 Fisher Drive
Peterborough, Ontario K9J7A1

Dear Sirs/Madams:

This is concerning potential adverse health effects associated with exposure to radiofrequency (RF) radiation, specifically that from wireless routers. I am a public health physician who has been involved in issues related to electromagnetic fields (EMFs) for a number of years. I served as the Executive Secretary for the New York Powerline Project in the 1980s, a program of research which showed that children living in homes with elevated magnetic fields coming from powerlines suffered from an elevated risk of developing leukemia. I have edited two books on effects of EMFs, including RF radiation. I served as the co-editor of the Bioinitiative Report (www.bioinitiative.org), a comprehensive review of the literature on this subject. The public health chapter from this report was subsequently published in a peer reviewed journal, and that is attached. Also I testified before the President's Cancer Panel on this subject in 2009, and a publication coming from that testimony is also attached. Thus this is a subject which I know well, and one on which I take a public health approach that has as a fundamental principle the need to protect against risk of disease even when one does not have all the information that would be desirable.

There is clear and strong evidence that intensive use of cell phones increases the risk of brain cancer, tumors of the auditory nerve and cancer of the parotid gland, the salivary gland in the cheek by the ear. The evidence for this conclusion is detailed in the attached publications. WiFi uses similar radiofrequency radiation (1.8 to 5.0 GHz), although the intensity of exposure in the immediate environment is much lower than what one gets from holding a cell phone close to your head. The difference between a cell phone and a WiFi environment, however, is that while the cell phone is used only intermittently a WiFi environment is continuous. In addition WiFi transmitters are indoors, where people (and in this case, children) may be very close to them. There is evidence from Scandinavian studies of cell phone usage that children who use cell phones are about five times more likely to develop brain cancer than if use starts as an adult. Thus it is especially important to protect children.

To my knowledge there has not been any health investigation of individuals living or working in WiFi environments as compared to others who are not. However, because the radiation is the same as those for cell phones, there is every reason to assume that the health effects would be the same, varying only in relation to the total dose of radiation. Wired facilities do not generate any RF radiation. While there is not specific proof that WiFi increases risk of cancer, there is certainly no evidence that it is safe. I urge you to not put WiFi in any school. Children should not be put at increased risk of developing cancer.

Yours sincerely,



David O. Carpenter, M.D.
Director, Institute for Health and the Environment
University at Albany

Dr., CEO Andrew Zuckerman
Montgomery County Schools
Carver Educational Services Center
850 Hungerford Drive
Rockville, MD 20850
U.S.A

13th December 2015

PhD Mikko Ahonen, Tampere, Finland
MD Lena Hedendal, Luleå, Sweden
MSc. Tarmo Koppel, Tallinn, Estonia

1. Regarding: Measurements related problems in the MCPS Wi-Fi Report

We have analysed the measurement report and would like to note the following:

- In the **Comparison-table 2.2.** the MCPS provides only average values, no peak values. In cell phone technologies (like GSM) the difference between average and peak value is 2-fold. **In Wireless local area technologies like Wi-Fi, the difference between average value and peak value is up to 100-fold** (Ferro & Potorti, 2005). Note that in the table 2.2. by the MCPS only average values are presented. Later you provide **in the chapter 7.2.2 Maximum, Instantaneous Power Density, which needs attention since these levels occasionally exceeded in your school measurements allowable EMC-levels (EN60601-1 → 3 V/m) for medical instruments** (Robinson *et al.*, 2003).

- **Almost all MCPS measurements were done in the near field of the devices under 3 wavelengths.** The wavelength for 2,4 GHz is 12,5 cm and for 5 GHz is 6 cm. That means that the near field will be <37,5 cm for 2,4 GHz and <18 cm for 5 GHz. In order to assess power density exposure in near field one needs to measure both electric and magnetic field components.

- The MCPS has not provided **information about Wi-Fi technology, namely it's beacon signal.** This signal, officially **SSID (Service Set Identifier)**, is created by the access point (AP) by sending constantly SSID 10 times in a second, at 10 Hz (Ferro and Poporti, 2005). **Mobile industry has patented technology to avoid this constant SSID sending for health reasons** (Swisscom, 2004). This SSID sending at 10 Hz is an additional risk-factor and it should be mentioned. Our brain operates in alpha, beta and gamma bands. This Wi-Fi beacon overlaps the alpha band. Low-frequency EMFs (including low-frequency pulses) have an effect on evoked potentials of the brain (Carrubba *et al.*, 2008).

- Because of the risk of this 10 Hz Beacon signal of Wi-Fi, The European Academy for Environmental Medicine has assigned very strict precautionary RF-levels for Wi-Fi (Belyaev et al., 2015). Please, pay attention to Wi-Fi RF power density peak-levels in the next picture.

RF source Max Peak/Peak Hold	Daytime exposure	Nighttime exposure	Sensitive populations ¹⁾
Radio broadcast (FM)	10,000 $\mu\text{W}/\text{m}^2$	1000 $\mu\text{W}/\text{m}^2$	100 $\mu\text{W}/\text{m}^2$
TETRA	1000 $\mu\text{W}/\text{m}^2$	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$
DVB-T	1000 $\mu\text{W}/\text{m}^2$	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$
GSM (2G) 900/1800 MHz	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$
DECT (cordless phone)	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$
UMTS (3G)	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$
LTE (4G)	100 $\mu\text{W}/\text{m}^2$	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$
GPRS (2.5G) with PTCCH (8.33 Hz pulsing)	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$	0.1 $\mu\text{W}/\text{m}^2$
DAB+ (10.4 Hz pulsing)	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$	0.1 $\mu\text{W}/\text{m}^2$
Wi-Fi 2.4/5.6 GHz (10 Hz pulsing)	10 $\mu\text{W}/\text{m}^2$	1 $\mu\text{W}/\text{m}^2$	0.1 $\mu\text{W}/\text{m}^2$

Picture. Precautionary levels for RF-radiation. **For Wi-Fi less than 10 $\mu\text{W}/\text{m}^2$ (peak value), which is 0,001 $\mu\text{W}/\text{cm}^2$ (peak value).** By the European Academy for Environmental Medicine (Belyaev et al., 2015, p. 356)

- We would like to draw attention to long-term exposure related health risks.

Radiofrequency radiation from Wi-Fi devices causes fertility problems as shown by several in vivo and in vitro studies (see for example Atasoy et al., 2013, Avendaño et al., 2012, Dasdag et al., 2015a, Shokri et al., 2015).

Additionally, **RF-radiation from Wi-Fi access points (AP) causes oxidative stress in cells which leads to several disorders** (see for example Nazıroğlu et al., 2012, Aynali et al., 2013, Salah et al., 2013). The overall detrimental impact of RF radiation induced oxidative stress is summarised in the review of Yakymenko et al. (2015).

2. Regarding: The IARC classification of RF-EMF as Group 2B, i.e., ‘possibly’ carcinogenic to humans and the MCPS Report’s inaccurate interpretation

The classification of radiofrequency electromagnetic fields (RF-EMF) as Group 2B, i.e., ‘possibly’ carcinogenic to humans, was made by 30 scientists from 14 countries at a meeting 2011 for the International Agency for Research on Cancer (IARC), World Health Organization (IARC 2011, Baan et al. 2012). **The working group mainly based their classification on one cohort study (Schüz et al., 2006) and five case-control studies (Muscat et al., 2000, Inskip et al., 2001, Auvinen et al., 2002, The Interphone study group, 2010, Hardell et al., 2011).**

They also reviewed more than 40 studies that assessed the carcinogenicity of RF-EMF in rodents, including seven 2-year cancer bioassays and also many studies with endpoints relevant to mechanisms of carcinogenesis, including genotoxicity, effects on immune function, gene and protein expression, cell signaling, oxidative stress, and apoptosis (Baan et al., 2011).

The referred INTERPHONE study (The Interphone study group, 2010), in the MCPS radiation report, was one of the case-control studies. **The Interphone study was a multicentre study of mobile phone use and brain tumours, including malignant tumours in the brain as glioma and benign tumours as acoustic neuroma and meningioma.** The pooled analysis included 2708 glioma cases and 2972 controls (participation rates 64% and 53%, respectively). In the Interphone study a regular user of mobile phones had an average of at least one call per week for a period of ≥ 6 months. **This very low user group was compared to several other groups of low users compared to nowadays more extensive use of mobile phones.** The highest group of users, ≥ 1640 hours was divided in three sub groups depending on how many years they had used a mobile phone. For the shortest time span on 1-4 years only 23 of the glioma cases and 8 of the controls had used their mobile phones for more than 1640 hours. If any of these 23 persons with a brain cancer or any of the 8 controls had used their mobile phones for only one year they would have used it at least in average for four and a half hours a day during a year. If they instead had talked in their mobile phones during four years it would be for an average of a little more than an hour a day. For the group of users between 5 and 9 years, 84 cases and 73 controls, the use per day would be at least between 54 minutes and 30 minutes. **For the long user group of 10 years or more, 93 cases and 73 controls, they talked in their mobile phones for 27 minutes a day or less for more than 10 years of use.**

For the main part of cases their use of mobile phones had been for a lot less than four hours a day. Today when most people use only their mobile phone and landline phones both at home and at work are becoming scarce, an amount of 4 hours or more wireless telephone use / day for salesman, telephone operators and so on is not uncommon.

In the Interphone study there was an statistical significant increased risk for a malignant brain tumour of 1.4 times (odds ratio, OR, 1.4, 95% CI 1.03-1.89) only for the highest user group of a total on more than 1640 hours.

Hardell et al. (2011) in Sweden found that **cases who had used a mobile phone for more than 1 year had an increased risk for glioma of 1.3 (OR 1.3, 95% CI 1.1-1.6).**

The risk increased with increasing time since first use and with total call time, reaching 3.2 times (OR 3.2, CI 2.0-5.1) for more than 2000 hours of use. Use of the mobile phone on the same side of the head as the tumour was associated with higher risk.

Since 2011 several other studies have been published which are strengthening the possible association between RF-EMF and cancer. Using the Bradford Hill viewpoints for evaluating strengths of evidence of the risk for brain tumours associated with use of mobile and cordless phones the classification should be upgraded to group 1 carcinogen, i.e., “the agent is carcinogenic to humans” (Hardell & Carlberg, 2013).

New case-control studies have verified Hardell's studies (Coureau et al., 2014) and up to 20 years of mobile phone use have found even higher risk for brain tumours (Hardell & Carlberg, 2015).

A newly published study has found a tumor promotion effect on mice from exposure to radiofrequency electromagnetic fields below exposure limits for humans (Lerchl *et al.*, 2015). RF-EMFs do not cause direct DNA damage. On the contrary **numerous studies have shown generation of reactive oxygen species (ROS) that can cause oxidative damage of DNA. This is a well-known mechanism in carcinogenesis for many agents.** The broad biological potential of ROS and other free radicals makes radiofrequency radiation a potentially hazardous factor for human health, not only cancer risk but also other health effects (Yakymenko *et al.*, 2015).

The IARC classification of RF-EMF as Group 2B, possibly carcinogenic to humans, doesn't only include exposure from mobile phones near the ear. **The classification includes all sources of RF-EMFs.** The exposure from mobile phone base stations, Wi-Fi access points, smart phones, laptops and tablets can be long term, sometimes around the clock both at home and at school. **This constant exposure to lower levels of exposure may be as deleterious to health as higher exposure during short time** (Fragopoulou et al., 2012, Dasdag et al., 2015b). **This risk may be accentuated for children because their probable longer use of wireless devices** (Morgan et al., 2014). **Children are also growing and have more immature cells which can be more sensible to RF-EMF** (Markova et al., 2010)

In conclusion, long term health effects from RF EMFs are still under investigation and a significant amount of troublesome scientific evidence has surfaced. By using wireless technologies at close range, long term health risks cannot be excluded. Therefore, we recommend schools to use wired technologies.

Respectfully submitted

Sincerely,



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Open letter by British medical doctors: Health and safety of Wi-Fi and mobile phones

We wish to highlight our concern over the safety of exposure to microwave radiation from wireless technology, particularly for vulnerable groups like children, pregnant women, the elderly and those with compromised health.

There is growing concern that chronic (long-term) exposure to radiofrequency/microwave radiation from wireless technologies causes damage, particularly genetic damage, cognitive damage, cancer and decreased fertility. There is now substantial evidence of a link between mobile phone use and brain cancer. This was recognised by the International Agency for Research on Cancer (IARC)'s 30-strong panel of scientists, which in 2011 classed radiofrequency radiation as "possibly carcinogenic".

Additionally, doctors are encountering a significant and growing number of people presenting with a range of acute (short-term) symptoms from wireless radiation, including headaches, palpitations, rashes, fatigue, sleep disturbance, allergies and memory and concentration problems.

International medical agencies have recognised the evidence of harm (see appended list) but these rulings may take many years to be reflected in public health policy. This controversy is a common characteristic of scientific understanding when environmental exposures are new.

New technologies and substances often come with scientific conflict, which can continue for several decades before consensus is achieved. Commercial pressures often delay the acceptance of health risks, even when scientific evidence is compelling. In the case of tobacco, asbestos, x-rays and leaded petrol, for example, it took many decades before damage was established and accepted by health agencies and, during those decades, millions of people suffered ill health and death as a result of the delay. Now, despite evidence of harm, wireless technology is being rolled out widely.

We urge health agencies and the public to act immediately to reduce exposure to radiofrequency/ microwave radiation. This is especially important for children, who are physiologically more vulnerable to this exposure, and for whom adults have a safeguarding responsibility. **Children's health should be put ahead of convenience and commercial benefits. Children should not use mobile phones except in an emergency, and WiFi should be replaced with wired alternatives in schools and other settings where children spend considerable time.**

Yours faithfully,

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Dr Dee Marshall MBBS, MFHom – Medical Doctor
Dr Charles Forsyth MBBS, FFHom – Medical Doctor
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Appendix – International Rulings

1. In 2011 the **World Health Organization’s scientific panel, the International Agency for Research on Cancer (IARC)**, reviewed all the evidence on carcinogenesis (cancer-causing) and categorised electromagnetic radiation from mobile phones and Wi-Fi as **Possibly Carcinogenic (Class 2B)**.

See http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf

2. **The Council of Europe has called for member states to take measures to reduce exposure to electromagnetic fields and give preference to wired internet connections for children, particularly in schools and classrooms.**

The Parliamentary Assembly stated that “the Assembly regrets that, despite calls for the respect of the precautionary principle and despite all the recommendations, declarations and a number of statutory and legislative advances, there is still a lack of reaction to known or emerging environmental and health risks and virtually systematic delays in adopting and implementing effective preventive measures. Waiting for high levels of scientific and clinical proof before taking action to prevent well-known risks can lead to very high health and economic costs, as was the case with asbestos, leaded petrol and tobacco.”

See <http://assembly.coe.int/mainf.asp?link=/documents/adoptedtext/ta11/eres1815.htm>

3. **The BioInitiative Report**, updated in 2012 by 29 scientists, states that **biological effects are clearly established and occur at very low levels of exposure to electromagnetic fields and radiofrequency radiation** from just minutes of exposure to mobile phone masts (cell towers), Wi-Fi, and wireless utility ‘smart’ meters.

See <http://www.bioinitiative.org/conclusions>

4. **The American Academy of Environmental Medicine** stated in a 2012 Position Paper that “**Multiple studies correlate RF exposure with diseases such as cancer, neurological disease, reproductive disorders, immune dysfunction, and electromagnetic hypersensitivity.**”

See http://aaemonline.org/emf_rf_position.html

6. **International Society of Doctors for the environment (ISDE) and Irish Doctors’ Environmental Association (IDEA)** state that “**there is sufficient scientific evidence to warrant more stringent controls** on the level and distribution of electromagnetic radiation [EMR]. The joint statement and recommendations are part of a call by medical and scientific experts for safe technologies in schools.”

See <http://www.env-health.org/news/members-news/article/isde-idea-statement-on>

5. **The Safe Schools Report 2012** lists statements by **other doctors and medical associations** raising concerns over children’s exposure to electromagnetic fields from Wi-Fi and other wireless technology.

See <http://wifischools.org.uk/resources/safeschools2012.pdf>



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July 10, 2009.

Open Letter to Parents, Teachers, & School Boards Regarding Wi-Fi Networks in Schools and Cell Phone Antennas near School Property

I am a scientist who does research on the health effects of electromagnetic radiation and I am becoming increasingly concerned that a growing number of schools are installing WiFi networks and are making their school grounds available for cell phone antennas.

You will be told by both the federal government (Federal Communication Commission in the US; Health Canada and Industry Canada in Canada) as well as by the Wi-Fi provider that this technology is **safe** provided that exposures to radio frequency radiation remain below federal guidelines.

This information is **outdated** and **incorrect** based on the growing number of scientific publications that are reporting adverse health and biological effects below our “short-term, thermal-based” guidelines (see www.bioinitiative.org) and the growing number of scientific and medical organizations that are asking for stricter guidelines to be enforced.

For these reasons it is irresponsible to introduce Wi-Fi microwave radiation into a school environment where young children and school employees spend hours each day.

FACT:

- 1. GUIDELINES: Guidelines for microwave radiation (which is what is used in Wi-Fi) range 5 orders of magnitude in countries around the world.** The lowest guidelines are in Salzburg Austria and now in Liechtenstein. The guideline in these countries is 0.1 microW/cm². See short video (<http://videos.next-up.org/SfTv/Liechtenstein/AdoptsTheStandardOf06VmBioInitiative/09112008.html>). In Switzerland the guideline is 1 and in both Canada and the US it is 1000 microW/cm²!

Why do Canada and the US have guidelines that are so much higher than other countries? Our guidelines are based on a short-term (6-minute in Canada and 30-minute in US) heating effect. It is assumed that if this radiation does not heat your tissue it is “safe”. This is NOT correct. Effects are documented at intensities well below those that are able to heat body tissue. See attached report: *Analysis of Health and Environmental Effects of Proposed San Francisco Earthlink Wi-Fi Network* (2007). These biological effects include increased permeability of the blood brain barrier, increased calcium flux, increase in cancer and DNA breaks, induced stress proteins, and nerve damage. Exposure to this energy is associated with altered white blood cells in school children; childhood leukemia; impaired motor function, reaction time, and memory; headaches, dizziness, fatigue, weakness, and insomnia.

- 2. ELECTRO-HYPER-SENSITIVITY:** A growing population is adversely affected by these electromagnetic frequencies. The illness is referred to as “electro-hyper-sensitivity” (EHS) and is recognized as a disability in Sweden. The World Health Organization defines EHS as:

“ . . . a phenomenon where individuals experience adverse health effects while using or being in the vicinity of devices emanating electric, magnetic, or electromagnetic fields (EMFs). . . EHS is a real and sometimes a debilitating problem for the affected persons, while the level of EMF in their neighborhood is no greater than is encountered in normal living environments. Their exposures are generally several orders of magnitude under the limits in internationally accepted standards. “

Health Canada acknowledges in their Safety Code 6 guideline that some people are more sensitive to this form of

energy but they have yet to address this by revising their guidelines.

Symptoms of EHS include sleep disturbance, fatigue, pain, nausea, skin disorders, problems with eyes and ears (tinnitus), dizziness, etc. It is estimated that 3% of the population are severely affected and another 35% have moderate symptoms. Prolonged exposure may be related to sensitivity and for this reason it is imperative that children's exposure to microwave radiation (Wi-Fi and mobile phones) be minimized as much as possible.

3. **CHILDREN'S SENSITIVITY:** Children are more sensitive to environmental contaminants and that includes microwave radiation. The Stewart Report (2000) recommended that children not use cell phones except for emergencies. The cell phone exposes your head to microwave radiation. A wireless computer (Wi-Fi) exposes your entire upper body and if you have the computer on your lap it exposes your reproductive organs as well. Certainly this is not desirable, especially for younger children and teenagers. For this reason we need to discourage the use of wireless technology by children, especially in elementary schools. That does not mean that students cannot go on the Internet. It simply means that access to the Internet needs to be through wires rather than through the air (wireless, Wi-Fi).
4. **REMOVAL OF WI-FI:** Most people do not want to live near either cell phone antennas or Wi-Fi antennas because of health concerns. Yet when Wi-Fi (wireless routers) are used inside buildings it is similar to the antenna being inside the building rather than outside and is potentially much worse with respect to exposure since you are closer to the source of emission.

Libraries in France are removing Wi-Fi because of concern from both the scientific community and their employees and patrons.

The Vancouver School Board (VSB) passed a resolution in January 2005 that prohibits construction of cellular antennas within 1000 feet (305 m) from school property.

Palm Beach, Florida, Los Angeles, California, and New Zealand have all prohibited cell phone base stations and antennas near schools due to safety concerns. The decision not to place cell antennas near schools is based on the likelihood that children are more susceptible to this form of radiation. **Clearly if we do not want antennas "near" schools, we certainly do not want antennas "inside" schools!** The safest route is to have wired internet access rather than wireless. While this is the more costly alternative in the short-term it is the least costly alternative in the long run if we factor in the cost of ill health of both teachers and students.

5. **ADVISORIES:** Advisories to limit cell phone use have been issued by the various countries and organizations including the UK (2000), Germany (2007), France, Russia, India, Belgium (2008) as well as the Toronto Board of Health and the Pittsburgh Cancer Institute (July 2008). While these advisories relate to cell phone use, they apply to Wi-Fi exposure as well since both use microwave radiation. If anything, Wi-Fi computers expose more of the body to this radiation than do cell phones.
6. **PRECAUTIONARY PRINCIPLE:** Even those who do not "accept" the science showing adverse biological effects of microwave exposure should recognize the need to be careful with the health of children. For this reason we have the Precautionary Principle, which states:

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capability. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost effective measures to prevent environmental degradation.

In this case "States" refers to the School Board and those who make decisions about the health of children.

The two most important environments in a child's life are the home (especially the bedroom) and the school. For this reason it is imperative that these environments remain as safe as possible. **If we are to err, please let us err on the side of caution.**

Respectfully submitted,
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July 10, 2009

Shallow Minds: How the Internet and Wi-Fi in Schools Can Affect Learning

By Cindy Lee Russell, MD
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Most of us cannot live without our computers, text messaging, e-mail, and immediate access to the vast cloud of information, especially kids and teenagers who have grown up in the age of the Internet. In fact, more schools are integrating computers at younger ages, even in kindergarten. Forty-nine states are phasing out cursive handwriting altogether. What effects does it have, however, on learning, brain development, cognition, and brain health? Studies have shown some interesting ways that technology is rewiring and shaping our brain, which may not be “all good.”

A growing body of scientific evidence suggests that the Internet, with its distractions and interruptions, is turning us into scattered, superficial thinkers. What does that portend for our kids?

Multitasking and Internet Addiction

Nicholas Carr explains, in his book “The Shallows,” that we are changing the way we process information. “Dozens of studies by psychologists, neurobiologists, educators, and Web designers point to the same conclusion: When we go online, we enter an environment that promotes cursory reading, hurried and distracted thinking, and superficial learning... The Net delivers precisely the kind of sensory and cognitive stimuli—repetitive, intensive, interactive, addictive, that have been shown to result in strong and rapid alterations in brain circuits and functions.”

Researchers from Stanford, in 2009, gave a battery of cognitive tests to a group of heavy and light media Internet multitaskers. They found that the heavy multitaskers were much more easily distracted by “irrelevant environmental stimuli” and had less control over their working memory. In addition, they were much less able to focus on a particular task. Professor Clifford Nass, who led the research, stated intensive multitaskers are “suckers for irrelevancy. Everything distracts them.” (5)

“Teaching is a human experience. Technology is a distraction when we need literacy, numeracy, and critical thinking.” Paul Thomas, author and associate professor of education at Furman University

Law School Professors Ban Laptops in Classrooms

Several years ago, professors who were irritated with students surfing the Web and hiding behind laptop screens began banning the use of the Internet or laptops in the classroom. Laptops have been banned in classes at Harvard Law School, Yale, George Washington University, University of Virginia, and South Texas College of Law, to mention a few. (4)(15) A 2006 study by Carrie Fried backed up the policies, demonstrating that students who used laptops in

class spent considerable time multitasking. They more importantly found that the level of laptop use was negatively related to several measures of student learning. (3)

A 2012 survey by Elon University, the Pew Internet, and American Life Project asked over 1,000 leaders in the U.S. their thoughts about cognition in our millennial generation. They were asked to consider how the Internet and its environment are changing, for better or worse. Overall, the survey found that multitasking is the new norm and that hyper-connectivity may be leading to a lack of patience and concentration. The “always on” ethos may be encouraging a culture of expectation and instant gratification.

Brain Maturation, Learning, Memory, and Intelligence

The maturation of intelligence requires quiet, deep thought, and time. Established research findings in cognitive science leads to the conclusion that laptop use, especially with Wi-Fi access, could interfere with learning.

The hippocampus, which lies under the cortex, is intimately involved in long-term memory storage. Initial experiences are stored and stabilized in the hippocampus and then later transferred to the cortex. Removal of the hippocampus does not affect long-term memories, but prevents new memories from forming.

Learning depends on the ability to transfer information from our working memory to long-term memory and weave this into other acquired knowledge. There is a bottleneck in the passage of working memory to long-term memory. We have a limited ability as humans to capture and process information. The Internet provides too many choices and too much information at once. Excess distracting information creates “overload,” preventing long-term memorization and important information is lost. No one disagrees that we need to protect our memories. As author Nicholas Carr highlights, personal memory is not just for the individual to function, but it shapes and sustains our collective cultural memory.

Brain Drain:

Adverse Neurologic and Health Effects of Wireless Microwave Communications

A growing body of peer reviewed research is showing neurologic damage to fetal brain and other systems from Wi-Fi and other microwave wireless sources. In a prior article, “Why-Fi: Is Wireless Communication Hazardous to Your Health?” in the Sept/Oct 2010 SCCMA *Bulletin*, the full range of effects of EMF from our cell phones and wireless devices was discussed. New basic science research in the last three years is confirming these findings. Initially, the Bioinitiative report of 2007 reviewed the biological effects of low level EMF. It found that there was clear evidence of adverse effects to living systems at current environmental exposures and at doses well below the threshold of the International Commission of Non-Ionizing Radiation Protection (ICNIRP) safety guidelines. Current microwave safety limits are based solely on the heating of tissue and do not take into account research showing negative biological effects on DNA, cancer, protein synthesis, skin tissue changes, sperm motility and viability, cognitive functioning, and disruption of the blood brain barrier.

Current Research on Cognition and Wireless Communication

Fetal Radiofrequency Radiation Exposure From 800-1900 MHz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice. *Scientific Reports*. March 2012.

Aldad et al noted that neurobehavioral disorders are increasingly prevalent in children with 3%-7% of school-aged children diagnosed with attention deficit hyperactivity disorder (ADHD). The etiology is unclear, however, an association between prenatal cellular telephone use and hyperactivity in children has been postulated by others. To test this, he exposed pregnant mice to cell phone radiation throughout gestation (days 1-17), with a sham cell phone control group. He found that the exposed group had dose responsive impaired neurologic transmission in the prefrontal cortex and that the mice exposed in utero were hyperactive and had impaired memory. He concluded “that these behavioral changes were due to altered neuronal developmental programming.”(3)

Microwave Radiation Induced Oxidative Stress, Cognitive Impairment, and Inflammation in Brain of Fischer Rats. Megha. 2012.

Megha evaluated the intensity of oxidative stress, cognitive impairment, and brain inflammation in rats exposed to typical cell phone microwave radiation. They were subjected to 900 and 1,800 MHz EMF for two hours a day, for 30 days. They state, “Significant impairment in cognitive function and induction of oxidative stress in brain tissues of microwave exposed rats were observed, in comparison with sham exposed groups... Results of the present study indicated that increased oxidative stress due to microwave exposure may contribute to cognitive impairment and inflammation in brain.”

Effect of Low Level Microwave Radiation Exposure on Cognitive Function and Oxidative Stress in Rats. Deshmukh. 2013.

The author highlights the exponential increase in wireless communication devices we are exposed to. He evaluated the effects of cell phone radiation on oxidation in tissues, in addition to cognition in rats. They subjected rats to 900 MHz EMF for two hours per day, five days a week, for 30 days, with an unexposed control group. “Results showed significant impairment in cognitive function and increase in oxidative stress, as evidenced by the increase in levels of MDA (a marker of lipid peroxidation) and protein carbonyl (a marker of protein oxidation) and unaltered GSH content in blood. Thus, the study demonstrated that low level MW radiation had significant effect on cognitive function and was also capable of leading to oxidative stress.”

The Internet Can Damage Teenage Brains

A large radiologic study from China, published July 2011, looked at structural brain changes in Internet-addicted teenagers. It is estimated that 24 million teenagers are addicted to the Internet in China. The researchers found a consistent atrophy of grey matter in parts of the brain and shrinkage of the surface of the brain in those addicted to the Internet. The effects were worse the longer the addiction. In addition, the study revealed changes in white matter of the brain, which

function to transmit messages in the brain to the grey matter. They concluded these structural abnormalities were most likely associated with functional impairments in cognitive control.

“It strikes me as a terrible shame that our society requires photos of brains shrinking in order to take seriously the common-sense assumption that long hours in front of screens is not good for our children’s health. Dr Aric Sigman, Fellow of the Royal Society of Medicine

WHO Classifies EMF as a Carcinogen

In 2011, The WHO/International Agency for Research on Cancer (IARC) classified radiofrequency electromagnetic fields as “possibly carcinogenic to humans (Group 2B), based on an increased risk for glioma, a malignant type of brain cancer¹, associated with wireless phone use.”

France Bans Wi-Fi in Schools, But Replaces With Ethernet

The French National Assembly, March 2013, passed an amendment to ban Wi-Fi in their schools until it’s proven “safe for human consumption.” They instead agreed to install far safer, wired Ethernet cable connections.

The Council of Europe has called for a ban on Wi-Fi use in schools and also recommends a wired alternative.

In Austria, the Austrian Medical Society has also issued a policy statement asking for a ban of Wi-Fi in schools.

The U.K. has a useful frequently-updated website on Wi-Fi in schools, which provides much scientific research. <http://www.wifiinschools.org.uk/> Still the controversy persists.

The Cost of a Virtual World

There are a host of concerns with classroom technology, and the virtual world it creates, that have not been explored in the rush to “modernize” education and prevent our kids from becoming “computer illiterate,” despite the fact that computers are designed for ease of use. These issues range from distraction in the classroom, impairment of cognitive development and long-term memory, deficiency in learning social skills, Internet addiction, cyber bullying, access to inappropriate content, eye fatigue, and security risks to online learning networks. In addition, the sheer cost of computers and continuous upgrades is likely to break many school budgets. We have not mentioned the issue of toxic e-waste, another growing public health problem.

Common Sense

We will not get rid of the Internet or computers. We should not ignore, however, the enlarging body of science that points to real threats to public health and, especially, our children’s safety and well-being. The best approach is precautionary. Reduce the risk by reducing the microwave emissions. It is our obligation as physicians and parents to protect our children. They are the

future and our legacy.

1. Remove wireless devices (white boards and routers) in schools in favor of wired connections and fiberoptic.
2. If there is Wi-Fi, then give teachers the authority to turn it off when not in use or if they feel it is not necessary.
3. Ban cell towers near or on schools.
4. Limit screen time on computers.
5. Limit or ban cell phone use in the class.
6. Limit or ban cell phone use at home.
7. Do not allow laptops to be placed on laps.
8. Undertake independent scientific studies on Wi-Fi and computer use that look at acute and long-term health effects.
9. Train teachers how to recognize symptoms of EMF reactions.
10. Conduct meetings with parents and teachers to address this issue in each school.

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Minimize health risks from electronic devices

Published in the September 2016 NJEA Review

by Adrienne Markowitz and Eileen Senn

Desktops, laptops, tablets, eBook readers, printers, projectors, smart boards, smart TVs, cellphones, cordless phones and wireless networks (WiFi) have become ubiquitous in schools. At their best, they are powerful tools for education. At their worst, they threaten the physical and mental health of teachers, paraeducators, secretaries, librarians and other school staff members and students who spend numerous hours using the devices.

Physical health risks from electronic devices include pain and tingling from repetitive strain injuries to the hands and wrists; pain in the neck, shoulders and back; dry, burning, itchy eyes, blurred vision and headaches; altered sleep patterns and next-day fatigue from exposure to blue screen light; distracted driving; and various health problems from exposure to radiation.

Mental health risks arise from stress due to raised expectations for multitasking, productivity and proficiency with devices; dealing with malfunctioning devices; student and colleague distraction from and addiction to devices; and intrusion of devices into nonwork time.

WiFi devices emit radiation

Radio frequency (RF) electromagnetic frequency (EMF) radiation is sent and/or received by the antennae of phones, routers and other wireless devices. RF radiation is capable of causing cancer, reproductive, neurological and ocular effects. The amount of radiation exposure received depends on the amount of time exposed and distance from the source. Radiation levels fall off exponentially with distance from antennae. If you double the distance, the radiation is four times less. If you triple the distance, it is nine times less, and so on. Children and developing fetuses are particularly at risk because their bodies are still growing. People with implanted medical devices are at risk for device interference.

Hazards and solutions

The most straightforward ways to minimize health risks are to use electronic devices in moderation and to maximize your distance from them. There are also specific solutions to specific hazards listed below.

Local associations should work with their UniServ field representative to negotiate solutions that are in the control of district administrators such as providing training and ergonomic equipment and hard-wiring devices. Individuals should take steps within their control, such as:

For repetitive strain injuries

- Use voice control/speech recognition.
- Use ergonomic alternatives to traditional mice and keyboards.
- Use as many fingers as possible when typing and both thumbs when texting.

For neck, shoulder and back pain

- Ensure an ergonomic workstation.
- When using a hand-held device, support it and the forearms.
- Avoid bending the head down or jutting it forward.
- Take frequent, short breaks from the device.
- Ensure good posture and change positions frequently.
- Stand and do stretching exercises.

For eye pain, blurred vision and headaches

- Use sufficient, but not excessive, lighting.
- Use assistive technology built into Apple, Android and Windows devices.
- Enlarge and darken the cursor and pointer.
- Enlarge the font; magnify the text.
- Use text-to-speech instead of reading.
- Use special computer glasses.
- Relax the eyes on a minibreak.

For altered sleep patterns and next-day fatigue

- Stop using devices at least one hour before bedtime.

For distracted driving

- Use hands-free devices, preferably speakerphones.
- Pull over and park.
- Let someone else drive.

For radiation exposure

- Keep devices away from the body and bedroom.
- Carry phones in briefcases, etc., not on the body.
- Put devices on desks, not laps.
- Hard wire all devices that connect to the internet.
- Hard wire all fixed devices such as printers, projectors and boards.
- Use hard-wired phones instead of cell or cordless phones.
- Text rather than call.
- Keep conversations short or talk in person.
- Put devices in airplane mode, which suspends EMF transmission by the device, thereby disabling Bluetooth, GPS, phone calls, and WiFi.
- Use speaker phone or ear buds instead of holding the phone next your head.
- Take off Bluetooth devices when not using them.

For stress

- Training in device use, assistive technology.
- Easy access to user manuals.
- Easily available technical support.

Cell phones and cancer

The National Toxicology Program (NTP) is conducting the largest set of laboratory rodent studies to date on cellphone RF radiation. The studies cost \$25 million and are designed to mimic human exposure. They are based on the cellphone

frequencies and modulations currently in use in the United States. The NTP studies are designed to look at effects in all parts of the body.

On May 27, 2016, NTP released a report with partial results of the studies. They found increased occurrence of rare brain tumors called gliomas and increases in nerve tumors called schwannoma of the heart in male rats. The released results are partial because more rat studies and all of the mouse studies will be forthcoming by 2017. The cells that became cancerous in the rats were the same types of cells as those that have been reported to develop into tumors in human cellphone users.

The EMF produced by cellphones was classified as possibly carcinogenic to humans by the World Health Organization in 2011. They found that long-term use of a cell phone might lead to two different types of tumors, gliomas and acoustic neuroma, a tumor of the auditory nerve.

For more information

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Resolution 1815 (2011)¹

Final version

The potential dangers of electromagnetic fields and their effect on the environment

Parliamentary Assembly

1. The Parliamentary Assembly has repeatedly stressed the importance of states' commitment to preserving the environment and environmental health, as set out in many charters, conventions, declarations and protocols since the United Nations Conference on the Human Environment and the Stockholm Declaration (Stockholm, 1972). The Assembly refers to its past work in this field, namely [Recommendation 1863 \(2009\)](#) on environment and health: better prevention of environment-related health hazards, [Recommendation 1947 \(2010\)](#) on noise and light pollution, and more generally, [Recommendation 1885 \(2009\)](#) on drafting an additional protocol to the European Convention on Human Rights concerning the right to a healthy environment and [Recommendation 1430 \(1999\)](#) on access to information, public participation in environmental decision-making and access to justice – implementation of the Århus Convention.
2. The potential health effects of the very low frequency of electromagnetic fields surrounding power lines and electrical devices are the subject of ongoing research and a significant amount of public debate. According to the World Health Organization, electromagnetic fields of all frequencies represent one of the most common and fastest growing environmental influences, about which anxiety and speculation are spreading. All populations are now exposed in varying degrees to electromagnetic fields, the levels of which will continue to increase as technology advances.
3. Mobile telephony has become commonplace around the world. This wireless technology relies upon an extensive network of fixed antennae, or base stations, relaying information with radio-frequency signals. Over 1.4 million base stations exist worldwide and the number is increasing significantly with the introduction of third generation technology. Other wireless networks that allow high-speed Internet access and services, such as wireless local area networks, are also increasingly common in homes, offices and many public areas (airports, schools, residential and urban areas). As the number of base stations and local wireless networks increases, so does the radio-frequency exposure of the population.
4. While electrical and electromagnetic fields in certain frequency bands have wholly beneficial effects which are applied in medicine, other non-ionising frequencies, whether from extremely low frequencies, power lines or certain high frequency waves used in the fields of radar, telecommunications and mobile telephony, appear to have more or less potentially harmful, non-thermal, biological effects on plants, insects and animals as well as the human body, even when exposed to levels that are below the official threshold values.
5. As regards standards or threshold values for emissions of electromagnetic fields of all types and frequencies, the Assembly strongly recommends that the ALARA (as low as reasonably achievable) principle is applied, covering both the so-called thermal effects and the athermic or biological effects of electromagnetic emissions or radiation. Moreover, the precautionary principle should be applied when scientific evaluation does not allow the risk to be determined with sufficient certainty. Given the context of growing exposure of the population, in particular that of vulnerable groups such as young people and children, there could be extremely high human and economic costs if early warnings are neglected.

1. Text adopted by the Standing Committee, acting on behalf of the Assembly, on 27 May 2011 (see [Doc. 12608](#), report of the Committee on the Environment, Agriculture and Local and Regional Affairs, rapporteur: Mr Huss).



6. The Assembly regrets that, despite calls for the respect of the precautionary principle and despite all the recommendations, declarations and a number of statutory and legislative advances, there is still a lack of reaction to known or emerging environmental and health risks and virtually systematic delays in adopting and implementing effective preventive measures. Waiting for high levels of scientific and clinical proof before taking action to prevent well-known risks can lead to very high health and economic costs, as was the case with asbestos, leaded petrol and tobacco.

7. Moreover, the Assembly notes that the problem of electromagnetic fields or waves and their potential consequences for the environment and health has clear parallels with other current issues, such as the licensing of medication, chemicals, pesticides, heavy metals or genetically modified organisms. It therefore highlights that the issue of independence and credibility of scientific expertise is crucial to accomplish a transparent and balanced assessment of potential negative impacts on the environment and human health.

8. In light of the above considerations, the Assembly recommends that the member states of the Council of Europe:

8.1. in general terms:

8.1.1. take all reasonable measures to reduce exposure to electromagnetic fields, especially to radio frequencies from mobile phones, and particularly the exposure to children and young people who seem to be most at risk from head tumours;

8.1.2. reconsider the scientific basis for the present standards on exposure to electromagnetic fields set by the International Commission on Non-Ionising Radiation Protection, which have serious limitations, and apply ALARA principles, covering both thermal effects and the athermic or biological effects of electromagnetic emissions or radiation;

8.1.3. put in place information and awareness-raising campaigns on the risks of potentially harmful long-term biological effects on the environment and on human health, especially targeting children, teenagers and young people of reproductive age;

8.1.4. pay particular attention to "electrosensitive" people who suffer from a syndrome of intolerance to electromagnetic fields and introduce special measures to protect them, including the creation of wave-free areas not covered by the wireless network;

8.1.5. in order to reduce costs, save energy, and protect the environment and human health, step up research on new types of antenna, mobile phone and DECT-type device, and encourage research to develop telecommunication based on other technologies which are just as efficient but whose effects are less negative on the environment and health;

8.2. concerning the private use of mobile phones, DECT wireless phones, WiFi, WLAN and WIMAX for computers and other wireless devices such as baby monitors:

8.2.1. set preventive thresholds for levels of long-term exposure to microwaves in all indoor areas, in accordance with the precautionary principle, not exceeding 0.6 volts per metre, and in the medium term to reduce it to 0.2 volts per metre;

8.2.2. undertake appropriate risk-assessment procedures for all new types of device prior to licensing;

8.2.3. introduce clear labelling indicating the presence of microwaves or electromagnetic fields, the transmitting power or the specific absorption rate (SAR) of the device and any health risks connected with its use;

8.2.4. raise awareness on potential health risks of DECT wireless telephones, baby monitors and other domestic appliances which emit continuous pulse waves, if all electrical equipment is left permanently on standby, and recommend the use of wired, fixed telephones at home or, failing that, models which do not permanently emit pulse waves;

8.3. concerning the protection of children:

8.3.1. develop within different ministries (education, environment and health) targeted information campaigns aimed at teachers, parents and children to alert them to the specific risks of early, ill-considered and prolonged use of mobiles and other devices emitting microwaves;

8.3.2. for children in general, and particularly in schools and classrooms, give preference to wired Internet connections, and strictly regulate the use of mobile phones by schoolchildren on school premises;

- 8.4. concerning the planning of electric power lines and relay antenna base stations:
 - 8.4.1. introduce town planning measures to keep high-voltage power lines and other electric installations at a safe distance from dwellings;
 - 8.4.2. apply strict safety standards for the health impact of electrical systems in new dwellings;
 - 8.4.3. reduce threshold values for relay antennae in accordance with the ALARA principle and install systems for comprehensive and continuous monitoring of all antennae;
 - 8.4.4. determine the sites of any new GSM, UMTS, WiFi or WIMAX antennae not solely according to the operators' interests but in consultation with local and regional government authorities, local residents and associations of concerned citizens;
- 8.5. concerning risk assessment and precautions:
 - 8.5.1. make risk assessment more prevention oriented;
 - 8.5.2. improve risk-assessment standards and quality by creating a standard risk scale, making the indication of the risk level mandatory, commissioning several risk hypotheses to be studied and considering compatibility with real-life conditions;
 - 8.5.3. pay heed to and protect "early warning" scientists;
 - 8.5.4. formulate a human-rights-oriented definition of the precautionary and ALARA principles;
 - 8.5.5. increase public funding of independent research, in particular through grants from industry and taxation of products that are the subject of public research studies to evaluate health risks;
 - 8.5.6. create independent commissions for the allocation of public funds;
 - 8.5.7. make the transparency of lobby groups mandatory;
 - 8.5.8. promote pluralist and contradictory debates between all stakeholders, including civil society (Århus Convention).

The Health Argument against Cell Phones and Cell Towers

The biomedical evidence showing that the radiofrequency radiation emitted by cell phones and cell towers is harmful to health continues to grow. This document summarizes the health argument against cellular technology, whatever the benefits of that technology may be. You may wish to inform yourself about these arguments for any of several reasons:

- You use a cell phone.
- You encourage, or do not discourage, the use of cell phones by family members.
- You live in, or are contemplating moving into, a community close to a cell tower.
- Your school, college, fire station, or police station is considering permitting the installation of a cell tower on its property.
- Your community is considering permitting the installation of cellular repeaters, small-cell towers, or even full cell towers within its jurisdiction.

Below, I introduce myself, provide evidence of the harmfulness of cellular radiation, and show that U.S. Government is not protecting us from harm and is unlikely to do so in the near future. That means that we must protect ourselves and our families at the individual and the community levels while working toward protective action by governments at the local, state, and Federal levels.

Who am I?

I am a retired U.S. Government career scientist (Ph.D., Applied Physics, Harvard University, 1975). During my Government career, I worked for the Executive Office of the President of the United States, the National Science Foundation, and the National Institute of Standards and Technology. For those organizations, respectively, I addressed Federal research and development program evaluation, energy policy research, and measurement development in support of the electronics and electrical-equipment industries and the biomedical research community. I currently interact with other scientists and with physicians around the world on the impact of electromagnetic fields on human health.

Evidence of harm

I present below key evidence, and associated references, that the exposure of humans to radiofrequency radiation, and specifically cellular radiation, is harmful to health.

In 2016, the National Toxicology Program, at the National Institutes of Health, linked cellular radiation to brain and heart tumors.

The National Toxicology Program (NTP), at the National Institutes of Health (NIH), just published the “Partial Findings” of a \$25 million multi-year study of the impact of cellular radiation on health. The U.S. Food and Drug Administration “nominated” this NTP study. The NTP indicated that this is the largest and most complex study ever conducted by the NTP.

¹ Ronald M. Powell, Ph.D., USA, email ronpowell@verizon.net, web site <https://www.scribd.com/document/291507610/>.

The NTP study exposed each of six separate groups of male rats to one of the six possible combinations of three different levels of cellular radiation and two different modulation formats. The modulation format is the method used to impress information on the cellular signal. A separate seventh group of male rats was used as a “control”, that is, for comparison, and was protected from exposure to any cellular radiation.

The NTP study found a “likely” causal relationship between exposure to cellular radiation and the occurrence of malignant brain cancer (glioma) and malignant nerve tumors (schwannomas) of the heart in the male rats:

The rates of occurrence of brain glioma in the male rats ranged from 0 to 3.3 percent for the six groups exposed to radiation. The mean rate of occurrence was 2.0 percent across all six groups.²

The rates of occurrence of heart schwannoma in the male rats ranged from 1.1 to 6.6 percent for the six groups exposed to radiation. The mean rate of occurrence was 3.5 percent across all six groups.³

The seventh group of male rats, which was used as a control and which was protected from exposure to any cellular radiation, experienced no instances of brain glioma or heart schwannoma.

The NTP considered its findings so important to public health that it issued the “Partial Findings” (May 2016) prior to completing the full study. The NTP then presented those findings at an international conference (BioEM2016, June 2016) attended by 300 scientists from 41 countries. The NTP characterized the motivation for the early release of the “Partial Findings” this way:

“Given the widespread global usage of mobile communications among users of all ages, even a very small increase in the incidence of disease resulting from exposure to RFR [radiofrequency radiation] could have broad implications for public health. There is a high level of public and media interest regarding the safety of cell phone RFR and the specific results of these NTP studies.”

The NTP promised further findings from its study for publication through 2017. Included in those further findings will be test results on mice. You can learn more about this study from the following references:

Reference: NTP’s brief description of its study. National Toxicology Program: Cell Phones.
(<http://ntp.niehs.nih.gov/results/areas/cellphones/index.html>)

Reference: NTP’s published “Partial Findings” of the study. Michael Wyde, Mark Cesta, Chad Blystone, Susan Elmore, Paul Foster, Michelle Hooth, Grace Kissling, David Malarkey, Robert Sills, Matthew Stout, Nigel Walker, Kristine Witt, Mary Wolfe, and John Bucher, Report of Partial Findings from the National Toxicology Program Carcinogenesis Studies of Cell Phone Radiofrequency Radiation in Hsd: Sprague Dawley® SD rats (Whole Body Exposure), posted June 23, 2016.
(<http://biorxiv.org/content/biorxiv/early/2016/06/23/055699.full.pdf>)

Reference: Informative discussion of the NTP study. Environmental Health Trust, Frequently Asked Questions about the U.S. National Toxicology Program Radiofrequency Rodent Carcinogenicity Research Study.
(<http://ehtrust.org/science/facts-national-toxicology-program-cellphone-rat-cancer-study>)

² In the “Partial Findings” reference cited above, the mean (average) rate of occurrence for malignant glioma in male rats was determined from Table 1 on page 13 as follows: $(3 + 3 + 2 + 0 + 0 + 3)/(90 + 90 + 90 + 90 + 90 + 90) = 2.0$ percent.

³ In the “Partial Findings” reference cited above, the mean (average) rate of occurrence for malignant heart schwannoma in male rats was determined from Table 3 on page 15 as follows: $(2 + 1 + 5 + 2 + 3 + 6)/(90 + 90 + 90 + 90 + 90 + 90) = 3.5$ percent.

Reference: Announcement of the BioEM2016 presentation. Results of NIEHS' National Toxicology Program GSM/CDMA phone radiation study to be presented at BioEM2016 Meeting in Ghent, 05 June 2016 — 10 June 2016 Ghent University, Belgium.

(<http://www.alphagalileo.org/ViewItem.aspx?ItemId=164837&CultureCode=en>)

Reference: Viewgraphs presented by Michael Wyde, Ph.D., NTP study scientist, at BioEM2016 Meeting, Ghent, Belgium, June 8, 2016. NTP Toxicology and Carcinogenicity Studies of Cell Phone Radiofrequency Radiation.

(http://ntp.niehs.nih.gov/ntp/research/areas/cellphone/slides_bioem_wyde.pdf)

The NTP study reinforces the classification of radiofrequency radiation, including cellular radiation, as a possible human carcinogen, made by the International Agency for Research on Cancer of the World Health Organization in 2011.

In its "Partial Findings" the NTP noted that its study reinforces a decision made by the International Agency for Research on Cancer (IARC) of the World Health Organization (WHO) in 2011. That decision classified radiofrequency radiation, including specifically cellular radiation, as a Group 2B carcinogen (possible carcinogen for humans). This classification was based on the increased risk of malignant brain cancer (glioma) and acoustic neuroma (a benign tumor of the auditory nerve), which is a form of schwannoma (vestibular schwannoma).⁴

Reference: Announcement of the IARC classification. International Agency for Research on Cancer, IARC Classifies Radiofrequency Electromagnetic Fields as Possibly Carcinogenic To Humans, Press Release No. 208, 31 May 2011.

(http://www.iarc.fr/en/media-centre/pr/2011/pdfs/pr208_E.pdf)

Reference: Full report on the IARC classification. IARC Monographs: Non-Ionizing Radiation, Part 2: Radiofrequency Electromagnetic Fields, Volume 102, 2013.

(<http://monographs.iarc.fr/ENG/Monographs/vol102/mono102.pdf>)

The findings of the NTP study, in combination with the findings of other studies conducted since 2011, have greatly increased the likelihood that the IARC will raise its classification of radiofrequency radiation to Group 2A (probable carcinogen for humans) or even to Group 1 (known carcinogen for humans) in the near future.

In 2015, hundreds of international scientists appealed to the United Nations and the World Health Organization to warn the public about the health risks caused by electromagnetic fields (EMF), including radiofrequency radiation and, specifically, cellular radiation.

As of January 29, 2017, 224 scientists from 41 nations have signed an international appeal first submitted to the United Nations and to the World Health Organization in May 2015. These scientists seek improved protection of the public from harm caused by the radiation produced by many wireless sources, including "cellular and cordless phones and their base stations, Wi-Fi, broadcast antennas, smart meters, and baby monitors" among others. Together, these scientists "have published more than 2000 research papers and studies on EMF." They state the following:

⁴ The Mayo Clinic describes acoustic neuroma here: <http://www.mayoclinic.org/diseases-conditions/acoustic-neuroma/basics/definition/CON-20023851>.

“Numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines. Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being in humans. Damage goes well beyond the human race, as there is growing evidence of harmful effects to both plant and animal life.”

Reference: Welcome to EMFscientist.org.

(<https://www.emfscientist.org>)

Reference: International EMF Scientist Appeal: Scientists call for Protection from Non-ionizing Electromagnetic Field Exposure, May 15, 2015 (updated October 10, 2016).

(<https://www.emfscientist.org/index.php/emf-scientist-appeal>)

Reference: International Scientists Petition U.N. to Protect Humans and Wildlife from Electromagnetic Fields and Wireless Technology.

([https://www.emfscientist.org/images/docs/International EMF Scientist Appeal Description.pdf](https://www.emfscientist.org/images/docs/International_EMF_Scientist_Appeal_Description.pdf))

In 2012, the BioInitiative Working Group published the most comprehensive of the recent analyses of the international biomedical research, showing a multitude of biological effects from exposure to radiofrequency radiation, including cellular radiation, at levels below the current exposure guidelines set by the Federal Communications Commission (FCC).

The health risks posed by the expanding use of radiofrequency radiation in wireless devices are not limited to cancer, as devastating as that consequence is. The broad range of health effects was extensively reviewed in the BioInitiative Report 2012. This 1479-page review considered about 1800 peer-reviewed biomedical research publications, most issued in the previous five years. The BioInitiative Report 2012 was prepared by an international body of 29 experts, heavy in Ph.D.s and M.D.s, from 10 countries, including the USA which contributed the greatest number of experts (10). The report concluded the following:

“The continued rollout of wireless technologies and devices puts global public health at risk from unrestricted wireless commerce unless new, and far lower exposure limits and strong precautionary warnings for their use are implemented.”

Reference: BioInitiative Working Group, Cindy Sage, M.A. and David O. Carpenter, M.D., Editors, BioInitiative Report: A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Radiation, December 31, 2012.

(<http://www.bioinitiative.org>)

The BioInitiative Report 2012 documented, in its “RF Color Charts”, examples of eight categories of biological effects that occurred at levels below the current exposure guidelines set by the FCC:

- stress proteins, heat shock proteins, and disrupted immune function
- reproduction and fertility effects
- oxidative damage, reactive ion species (ROS), DNA damage, and DNA repair failure
- disrupted calcium metabolism
- brain tumors and blood-brain barrier
- cancer (other than brain) and cell proliferation

- sleep, neuron firing rate, electroencephalogram (EEG), memory, learning, and behavior
- cardiac, heart muscle, blood-pressure, and vascular effects.

These biological effects were attributed to “Radiofrequency Radiation at Low Intensity Exposure” from “cell towers, Wi-Fi, wireless laptops, and smart meters”.

Reference: See the “RF Color Charts”, accessed from the left column of the web page below.
<http://www.bioinitiative.org>

The U.S. Government is not protecting us.

The radiation exposure guidelines of the FCC do not protect us because they are outdated and based on a false assumption.

The current radiation exposure guidelines of the FCC were adopted in 1996, 20 years ago. Those guidelines are based primarily on an analysis by the National Council on Radiation Protection and Measurements (NCRP) which was published in 1986, 30 years ago. That was many years before the emergence of nearly all of the digital wireless devices in use today.

“The FCC-adopted limits for Maximum Permissible Exposure (MPE) are generally based on recommended exposure guidelines published by the National Council on Radiation Protection and Measurements (NCRP) in 'Biological Effects and Exposure Criteria for Radiofrequency Electromagnetic Fields,' NCRP Report No. 86, Sections 17.4.1, 17.4.1.1, 17.4.2 and 17.4.3. Copyright NCRP, 1986, Bethesda, Maryland 20814....”

Reference: Federal Communications Commission, Office of Engineering & Technology, Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields, OET Bulletin 65, Edition 97-01 (August 1997). See the last paragraph on page 64.
http://transition.fcc.gov/Bureaus/Engineering_Technology/Documents/bulletins/oet65/oet65.pdf

Those exposure guidelines have not been substantially changed since that analysis in 1986. They are based on the *thermal assumption* that the only harm that radiofrequency radiation can cause is due to tissue heating. This thermal assumption has been thoroughly disproved since, as biological effects have been found to occur at levels of radiation below, and even far below, those that cause significant tissue heating. Such lower levels are commonly referred to as *nonthermal* levels. The result is that many authorities now consider the FCC’s current exposure guidelines as entirely outdated and much too high (that is, much too permissive) to protect the public.

The evidence disproving the thermal assumption is based on the broadened understanding of the biological effects of radiofrequency radiation made possible by thousands of peer-reviewed papers published by international biomedical scientists since 1986. The BioInitiative Report 2012 is the most recent comprehensive review of that research and provides many examples of bioeffects occurring at nonthermal radiation levels, as described above. Further, the new study by the National Toxicology Program, also described above, added to the evidence disproving the thermal assumption. That study exposed rats to levels of radiation below those that cause significant heating, and both above and below the FCC’s current exposure guidelines as well. Yet, even below the FCC’s current exposure guidelines, the male rats still developed malignant brain cancer (glioma) and malignant tumors (schwannomas) of the nerves of the heart.

The shortcomings of the FCC's exposure guidelines are described in detail in the following reference:

Reference: Outdated FCC "Safety" Standards: The Five Fallacies of the Electromagnetic Radiation Exposure Limits.

(<http://ehtrust.org/policy/fcc-safety-standards/>)

The FCC is not a credible source for exposure guidelines because it lacks health expertise and because it is too heavily influenced by the wireless industries that it is supposed to regulate.

The FCC lacks the health expertise required for developing health-related radiation exposure guidelines. Further, the FCC seems more interested in assuring compatibility among electronic systems than in assuring the compatibility of electronic systems with human, animal, and plant life. Since the exposure guidelines relate to health, it would make more sense for them to be developed by an agency with health expertise, such as the Environmental Protection Agency (EPA).

In addition, the FCC lacks the impartiality required to be a source of credible guidelines. The FCC is too heavily influenced by the wireless industries that the FCC is supposed to regulate. The FCC has acted in partnership with the wireless industries by permitting wireless radiation levels far higher than the biomedical research literature indicates are necessary to protect human health. The success of the wireless industries in capturing the FCC, the committees in the U.S. Congress that oversee the FCC, and the Executive Branch is detailed in a recent monograph from the Center for Ethics at Harvard University.

Reference: Norm Alster, Captured Agency: How the Federal Communications Commission is Dominated by the Industries It Presumably Regulates (2015).

(<http://ethics.harvard.edu/news/new-e-books-edmond-j-safra-research-lab>)

As an example of that capture, President Obama, in 2013, appointed Thomas Wheeler, as the Chairman of the FCC. At that time, Mr. Wheeler was the head of the CTIA – The Wireless Association, which is the major lobbying organization for the wireless industries. This is the infamous "revolving door".

The FCC's decision to fast-track Fifth Generation (5G) cellular technology without prior study of its health impact demonstrates the FCC's disinterest in the public health.

On July 14, 2016, the FCC adopted new rules that would promote fast-tracking the expansion of cellular service to new and higher frequencies as part of the Fifth Generation (5G) of cellular technology. This decision will open selected frequency bands above 24 gigahertz (GHz) and up to 71 GHz. At the same time, the FCC has requested comment on opening even higher frequencies, possibly above 95 GHz.

Reference: FCC Takes Steps to Facilitate Mobile Broadband and Next Generation Wireless Technologies in Spectrum above 24 GHz: New rules will enable rapid development and deployment of next generation 5G technologies and services.

(http://transition.fcc.gov/Daily_Releases/Daily_Business/2016/db0714/DOC-340301A1.pdf)

Reference: Fact Sheet: Spectrum Frontiers Rules Identify, Open Up Vast Amounts of New High-Band Spectrum for Next Generation (5G) Wireless Broadband.

(http://transition.fcc.gov/Daily_Releases/Daily_Business/2016/db0714/DOC-340310A1.pdf)

All five commissioners of the FCC, including Chairman Thomas Wheeler, approved this expedited move to 5G. No commissioner called for evaluating the health impact before proceeding with 5G, despite the recent findings of the National Toxicology Program at NIH that cellular radiation likely causes tumors. Nor did even one commissioner express any interest in, or concern about, the impact of this new technology on public health. Rather, the FCC's emphasis was on the billions of dollars to be made by proceeding to implement 5G as rapidly as possible, with a minimum of regulatory interference, to assure an international competitive position.

In contrast to the FCC's disinterest in the impact of 5G on the public health, extensive written comments from individual members of the public and from many interested organizations raised a host of health concerns that were totally ignored in the FCC's presentations.

Reference: July 2016 Open Commission Meeting addressing "Spectrum Frontiers" and "Advancing Technology Transitions".

(<https://www.fcc.gov/news-events/events/2016/07/july-2016-open-commission-meeting>)

Reference: The FCC Approves 5G Millimeter Wave Spectrum Frontiers. Includes excerpts from selected comments provided to the FCC by individuals and organizations that expressed concern about the health impact of the FCC's plan for 5G.

(<http://ehtrust.org/policy/fcc-approves-5g-millimeter-wave-spectrum-frontiers/>)

Reference: Comments on FCC Docket 14-177, Spectrum Bands above 24 GHz. All of the comments submitted to the FCC about the key docket leading to the implementation of 5G.

(https://www.fcc.gov/ecfs/search/filings?proceedings_name=14-177&sort=date_disseminated,DESC)

U.S. Government agencies, and U.S. medical organizations, have disputed the validity of the FCC's exposure guidelines.

U.S. Government agencies, as well as U.S. medical organizations, have disputed the validity of the FCC's thermal exposure guidelines, maintaining that they are outdated and need to be updated to provide adequate protection of human beings, including children and seniors as well as other vulnerable groups.

U.S. Environmental Protection Agency

The Environmental Protection Agency (EPA) would be a better agency than the FCC to entrust with setting radiofrequency radiation exposure guidelines because the EPA has both health expertise and environmental responsibilities. The EPA is often cited by the FCC, and by the wireless industries, as one of the agencies that the FCC has *consulted* about the FCC's exposure guidelines, as if to increase the credibility of those guidelines. However, the fact that the EPA has *explicitly disputed* the validity of those guidelines is consistently omitted from those FCC citations.

Specifically, in 2002, the EPA addressed the limitations of the thermal exposure guidelines of the FCC, and the similar guidelines of private organizations, including the Institute of Electrical and Electronics Engineers and the International Commission on Non-Ionizing Radiation Protection:

"The FCC's current exposure guidelines, as well as those of the Institute of Electrical and Electronics Engineers (IEEE) and the International Commission on Non-ionizing Radiation Protection, are thermally based, and do not apply to chronic, nonthermal exposure situations.... The FCC's exposure guideline is

considered protective of effects arising from a thermal mechanism but not from all possible mechanisms. Therefore, the generalization by many that the guidelines protect human beings from harm by any or all mechanisms is not justified.”

“Federal health and safety agencies have not yet developed policies concerning possible risk from long-term, nonthermal exposures. When developing exposure standards for other physical agents such as toxic substances, health risk uncertainties, with emphasis given to sensitive populations, are often considered. Incorporating information on exposure scenarios involving repeated short duration/nonthermal exposures that may continue over very long periods of time (years), with an exposed population that includes children, the elderly, and people with various debilitating physical and medical conditions, could be beneficial in delineating appropriate protective exposure guidelines.”

Reference: Letters from Frank Marcinowski, Director, Radiation Protection Division, EPA, and Norbert Hankin, Center for Science and Risk Assessment, Radiation Protection Division, EPA, to Janet Newton, President, the EMR Network, with copies to the FCC and the IEEE, dated July 16, 2002.

(http://www.emrpolicy.org/litigation/case_law/docs/noi_epa_response.pdf)

In summary, the EPA makes the following points: (1) the FCC’s thermal exposure guidelines do *not* protect against all harm, only the harm caused by too much heating; (2) the FCC’s thermal exposure guidelines do *not* apply to “chronic, nonthermal exposure”, which is the type of exposure generated by cell towers and many other wireless devices; and (3) when new FCC guidelines are developed for chronic nonthermal exposures, they must accommodate “children, the elderly, and people with various debilitating physical and medical conditions” because those groups are not accommodated now.

U.S. Food and Drug Administration

The Food and Drug Administration (FDA) is also often cited by the FCC, and by the wireless industries, as one of the agencies that the FCC has consulted about exposure guidelines. But the FDA is the agency that “nominated” the NTP study of the possible health effects of cellular radiation, in part because of the FDA’s uncertainty about the validity of the FCC’s exposure guidelines:

“Currently cellular phones and other wireless communication devices are required to meet the radio frequency radiation (RFR) exposure guidelines of the Federal Communications Commission (FCC), which were most recently revised in August 1996. The existing exposure guidelines are based on protection from acute injury from thermal effects of RFR exposure, and may not be protective against any non-thermal effects of chronic exposures.”

Reference: Nominations from FDA’s Center for [for] Device[s] and Radiological Health, Radio Frequency Radiation Emissions of Wireless Communication Devices (CDRH), Executive Summary, as attached to transmittal letter from William T. Allaben, Ph.D., FDA Liaison, to Dr. Errol Zeiger, Coordinator, Chemical Nomination and Selection, National Toxicology Program, May 19, 1999,⁵ (http://ntp.niehs.nih.gov/ntp/htdocs/chem_background/exsumpdf/wireless051999_508.pdf)

The FDA’s wisdom in nominating the NTP study was well justified by the NTP’s publication of the “Partial Findings” described above. Those findings demonstrated both that the FCC’s exposure guidelines are not protective and that the thermal assumption on which those guidelines are based is invalid.

⁵ This date and the referenced URL were changed when this superior reference was posted, at my request, by the NTP/NIEHS/NIH.

U.S. Department of the Interior

In 2014 the Department of the Interior (Fish and Wildlife Service) also addressed the limitations of the FCC's thermal exposure guidelines. The Department of the Interior was motivated by the multiple adverse effects of electromagnetic radiation on the health, and the life, of birds, particularly in connection with cell towers. The Department of the Interior stated the following:

“However, the electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today.”

Reference: Letter from Willie R. Taylor, Director, Office of Environmental Policy and Compliance, Office of the Secretary, United States Department of the Interior, to Mr. Eli Veenendaal, National Telecommunications and Information Administration, U.S. Department of Commerce, dated February 7, 2014.

(https://www.ntia.doc.gov/files/ntia/us_doi_comments.pdf)

American Academy of Environmental Medicine

The American Academy of Environmental Medicine (AAEM), which trains physicians in preparation for Board Certification in Environmental Medicine, states the following:

“The AAEM strongly supports the use of wired Internet connections, and encourages avoidance of radiofrequency such as from WiFi, cellular and mobile phones and towers, and ‘smart meters’.”

"The peer reviewed, scientific literature demonstrates the correlation between RF [radiofrequency] exposure and neurological, cardiac, and pulmonary disease as well as reproductive and developmental disorders, immune dysfunction, cancer and other health conditions. The evidence is irrefutable."

“To install WiFi in schools plus public spaces risks a widespread public health hazard that the medical system is not yet prepared to address.”

Reference: American Academy of Environmental Medicine, Wireless Radiofrequency Radiation in Schools, November 14, 2013.

(<http://www.aeonline.org/pdf/WiredSchools.pdf>)

American Academy of Pediatrics

The American Academy of Pediatrics (AAP), whose 60,000 doctors care for our children, supports the development of more restrictive standards for radiofrequency radiation exposure in order to better protect the public, particularly the children. In a letter to the Federal Communications Commission (FCC) and the Food and Drug Administration (FDA), dated August 29, 2013, the AAP states the following:

“Children are not little adults and are disproportionately impacted by all environmental exposures, including cell phone radiation. Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children. It is essential that any new standard for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded throughout their lifetimes.”

Reference: American Academy of Pediatrics, letter dated August 29, 2013 addressed to The Honorable Mignon L. Clyburn, Acting Commissioner, Federal Communications Commission, and The Honorable Dr. Margaret A. Hamburg, Commissioner, U.S. Food and Drug Administration.

(<http://apps.fcc.gov/ecfs/document/view?id=7520941318>)

After reviewing the “Partial Findings” from the new study by the National Toxicology Program at the National Institutes of Health, described above, the American Academy of Pediatrics cautioned parents about the use of cell phones by their children:

“In light of the findings, the Academy continues to reinforce its recommendation that parents should limit use of cell phones by children and teens.”

Reference: American Academy of Pediatrics, AAP responds to study showing link between cell phone radiation, tumors in rats, May 27, 2016.

(<http://www.aappublications.org/news/2016/05/27/Cancer052716>)

The Telecommunications Act of 1996, in combination with the FCC’s exposure guidelines, empowers the wireless industries to mandate the exposure of the public to levels of radiofrequency radiation already found harmful to health.

The Telecommunications Act of 1996 bars state and local governments from objecting to the placement of cell towers on environmental/health grounds unless the FCC’s exposure guidelines would be exceeded. Specifically, the Act states the following:

“No State or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the Commission's [FCC’s] regulations concerning such emissions.”

Reference: Telecommunications Act of 1996, Section 704 Facilities Siting; Radio Frequency Emission Standards, page 117.

(<http://transition.fcc.gov/Reports/tcom1996.pdf>)

This Act, in combination with the FCC’s permissive exposure guidelines, strips state and local governments of the right to protect their own residents from levels of radiofrequency radiation already shown to be harmful to health. In effect, this Act transfers to the wireless industries the right to **mandate** the exposure of the public, including those most vulnerable to harm, to radiofrequency radiation without the need for further governmental action. State and local governments can still resist, but to do so they must confront this Act which is designed to frustrate their success. Even so, some governments do heroically resist and some do succeed.

Protecting ourselves and our families

We can act on our own to protect ourselves and our families, but only partially.

Instead of increasing our exposure to cellular radiation, and to the radiation from other digital wireless

devices, we can decrease our exposure and improve our chances for good health. Desirable steps in this direction include the following:

- Reduce or stop the use of cell phones. Reserve them for emergencies or other essential uses.
- Replace cordless telephones with corded telephones.
- Establish wired (Ethernet) interconnections between routers and the wireless devices that the routers support. Then turn off the wireless capabilities, such as Wi-Fi and Bluetooth, of them all.
- “Opt out” of the wireless smart meter on your residence, if your state or local electric power company permits. Many states, but not all, have an opt-out provision.
- Alert family members about the health risks posed by wireless devices, particularly for vulnerable groups such as pregnant mothers, unborn children, young and teenage children, adult males of reproductive age, seniors, the disabled, and anyone with a chronic health condition. Everyone is vulnerable, but these groups are more so.

Reference: For more information on reducing radiation at home, please see Ronald M. Powell, Ph.D., How to Reduce the Electromagnetic Radiation in Your Home, which is document (10) on the following list.

[\(https://www.scribd.com/document/291507610/\)](https://www.scribd.com/document/291507610/)

We can obtain better protection if we work together.

We can contribute our efforts to the hundreds of new organizations that are emerging nationwide to raise awareness about the health risks posed by the radiation exposure from wireless devices in homes, in the workplace, in schools, and in public places, especially where children are present. Through the Internet, look for organizations that address the intersection of health with cell phones, cordless phones, Wi-Fi, smart meters, and wireless desktop computers, laptops, and tablets. These wireless devices are the principal sources of radiofrequency radiation in the home.

Take care for our children. Today's adults grew up in an environment with much less radiofrequency radiation than exists today. Today's children are not so lucky. To have the same chance at a healthy life, they need a lot of help. Unfortunately, the levels of radiofrequency radiation in our environment are rising exponentially as governments and wireless industries continue to promote, and even mandate, the exposure of the public to ever higher levels of radiofrequency radiation, with no limit in sight. That means that many of our children will become chronically ill, and many will die, while still young adults. This is a tragedy in the making. To stop it will require greatly increased awareness of the problem and serious political action at multiple levels of government. That is no small task, but we all can help. We can join with others to become a part of the solution for ourselves and our families, but especially for our children and our grandchildren.

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Maryland Children’s Environmental Health and Protection Advisory Council (2016) [78 Studies Showing Health Effects from Cell Tower Radio Frequency](#)

FACTSHEET: ENVIRONMENTAL HEALTH TRUST ET AL. V. FCC

FCC's Lack of Adequate Review for Wireless Radiation Exposure Limits

LANDMARK FEDERAL COURT RULING AGAINST THE FCC

On August 13, 2021 the U.S. Court of Appeals for the D.C. Circuit ruled the Federal Communications Commission (FCC) ignored scientific evidence and failed to provide a reasoned explanation for its determination that its 1996 regulations adequately protect the public against all the harmful effects of wireless radiation.

FCC'S REFUSAL TO UPDATE 1996 LIMITS

The legal case challenged the FCC's 2019 decision not to update its 1996 regulations regarding allowable exposures of radiofrequency radiation (RF) from wireless technologies - including 5G, cell phones, cell towers, Wi-Fi, and wireless networks.

EVIDENCE OF BIOLOGICAL EFFECTS BELOW FCC LIMITS

FCC limits are based on the outdated belief that heating is the only proven harm from RF. Over 11,000 pages of evidence - 447 exhibits in 27 Volumes - was submitted to the Court documenting biological effects and illness from wireless radiation exposure at non-heating levels. Research has found brain damage, headaches, memory problems, reproduction damage, synergistic effects, nervous system impacts, brain cancer, genetic damage, as well as harm to trees, birds, bees, and wildlife.

THE COURT FINDINGS

The Court found that the FCC did not provide evidence of properly examining record evidence indicating non-cancer harm such as:

- impacts to children
- testimony of persons injured by wireless radiation
- impacts to the developing brain
- impacts to the reproductive system
- impacts to wildlife and the environment

THE COURT ORDER

The Court ordered the FCC to provide a reasoned determination as to whether the evidence warrants a change to 1996 RF limits especially in regards to:

- children's vulnerability
- long-term exposure
- environmental impacts
- new technological developments and the ubiquity of wireless
- how FCC's cell phone tests only measure heat and allow a space between the phone and body.

"The factual premise—the non-existence of non-thermal biological effects—underlying the current radiofrequency (RF) guidelines may no longer be accurate."

-2021 EHT et al. v. FCC RULING

TIMELINE

1980s: EPA tasked to develop RF safety limits for heating and biological effects.

1996: EPA is fully defunded and halts all research on RF. The FCC adopts RF limits developed by industry-tied groups- based on heating.

1999: FDA requests the National Toxicology Program (NTP) study RF because of the lack of safety data on long-term exposure.

2008/2009 Congressional Hearings

2012: GAO Report recommends rules be reassessed to reflect current use patterns and recent science.

2013-2019: FCC opens record on RF limits - gets over 1000 submissions.

2018: NTP releases \$30M animal study concluding "clear evidence" of cancer. FDA rejects the findings.

2019: FCC closes record, decides not to update its 1996 wireless RF limits.

2020: Cases filed against FCC.

2021: Ruling against FCC.

FCC's Lack of Adequate Review for Wireless Radiation Exposure Limits

THE BOTTOM LINE

FCC Compliance Does Not Ensure Safety

Most of the public assumes that current FCC safety limits for cell phones, cell towers, Wi-Fi, 5G, and wireless networks are based upon an up to date robust review of all relevant research. This assumption of safety is now clearly documented to be erroneous.

Lack of Oversight by Health and Environmental Agencies

The ruling reveals a lack of accountability with our federal health agencies regarding wireless radiation. The EPA, CDC, NIOSH, and NCI did not submit any reports to the Court, revealing that none of these agencies has reviewed the science on health effects to ensure safety for the public. The U.S. has no pre-market safety testing for health effects, no post-market surveillance, no environmental monitoring, and no meaningful interagency coordination.

FDA's Dismissal of Harm Deemed Insufficient

The Court states the FCC improperly relied on the FDA's conclusions that RF limits did not need an update. The FDA's submissions were described by the Court as "cursory" and "insufficient." Although the FDA later released a literature review, it was only focused on cancer, further confirming the fact that the FDA and U.S. safety agencies have failed to evaluate the numerous health effects documented in scientific studies, such as brain and reproductive system impacts. A US government review of the full body of recent science has simply never been done.

Children's Vulnerability Ignored by the FCC

The Court states the FCC "dismissed" the American Academy of Pediatrics recommendations for strengthened regulations that ensure children and pregnant women would be protected. The Court found the FCC failed to explain why it ignored research indicating children were more vulnerable to wireless: their developing brains are more sensitive, they absorb higher levels of RF deeper into their brains, and they will have a lifetime of exposure.

Wildlife Remains Unprotected

FCC's limits were designed in 1996 to protect only humans, not flora or fauna. The Court found that the FCC had "completely failed" to address the "substantive evidence of potential environmental harms" on the record, which included science showing serious impacts to birds, bees, trees, and plants.

"In the Department of the Interior's expert view, the Commission's RF radiation limits "continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today."

-2021 EHT et al. v. FCC

PETITIONERS

Environmental Health Trust (EHT), Consumers for Safe Cell Phones, Elizabeth Barris, and Theodora Scarato.

Children's Health Defense (CHD), Michelle Hertz, Petra Brokken, Dr. David Carpenter, Dr. Toril Jelter, Dr. Paul Dart, Dr. Ann Lee, Virginia Farver, Jennifer Baran, and Paul Stanley M.Ed. CHD's case was consolidated with EHT's.

Briefs and evidence were jointly filed.

Go to [EHTrust.org](https://ehtrust.org) for links to the ruling, briefs, and the latest science.

July 8, 202 Letter from EPA= Director, Radiation Protection Division, Office of Radiation and Indoor Air to Theodora Scarato Executive Director of Environmental Health Trust

----- Forwarded message -----

From: **Veal, Lee** <Veal.Lee@epa.gov>
Date: Wed, Jul 8, 2020 at 11:32 AM
Subject: RE: Letter with specific Questions Related to the FDA review and to the EPA, CDC, NIOSH and FDA Jurisdiction on EMFs
To: Theodora Scarato <Theodora.Scarato@ehtrust.org>

Dear Director Scarato;

Thank you for sending us your questions and references regarding radiofrequency (RF) radiation. Up through the mid-1990s, EPA did study non-ionizing radiation. The Telecommunications Act of 1996 directs the Federal Communications Commission (FCC) to establish rules regarding RF exposure, while the U.S. Food and Drug Administration (FDA) sets standards for electronic devices that emit non-ionizing or ionizing radiation. EPA does not have a funded mandate for radiofrequency matters, nor do we have a dedicated subject matter expert in radiofrequency exposure. The EPA defers to other agencies possessing a defined role regarding RF. Although your questions are outside our current area of responsibilities, we have provided a response to each one as you requested.

1. *What is your response to these scientists' statements regarding the FDA report and the call to retract it?*

EPA Response: The EPA does not have a funded mandate for radiofrequency matters, has not conducted a review of the FDA report you cited or the scientists' statements, and therefore has no response to it.

2. *To the FDA- What consultants were hired for the FDA review and report on cell phone radiation?*

EPA Response: This is not an EPA matter. Please refer this question to the FDA.

3. *What US agency has reviewed the research on cell phone radiation and brain damage? I ask this because the FDA only has looked at selected studies on cancer. If your agency has not, please simply state you have not.*

EPA Response: EPA's last review was in the 1984 document [Biological Effects of Radiofrequency Radiation \(EPA 600/8-83-026F\)](#). The EPA does not currently have a funded mandate for radiofrequency matters.

4. *What US agency has reviewed the research on damage to memory by cell phone radiation? If so, when and send a link to the review.*

EPA Response: EPA's last review was in the 1984 document [Biological Effects of Radiofrequency Radiation \(EPA 600/8-83-026F\)](#). The EPA does not currently have a funded mandate for radiofrequency matters.

5. *What US agency has reviewed the research on damage to trees from cell phone radiation? If so, when was it issued and send a link to the review. [Note this study showing damage from long term exposure to cell antennas.](#)*

EPA Response: The EPA does not have a funded mandate for radiofrequency matters, and we are not aware of any EPA reviews that have been conducted on this topic. We do not know if any other US agencies have reviewed it.

6. *What US agency has reviewed the research on impacts to birds and bees? If so, when and send a link to the review. I will note the latest research showing [possible impacts to bees](#) from higher frequencies to be used in 5G.*

EPA Response: The EPA does not have a funded mandate for radiofrequency matters, and we are not aware of any EPA reviews that have been conducted on this topic. We do not know if any other US agencies have reviewed it.

7. *What is a safe level of radiofrequency radiation? I ask this because the FDA and FCC both state they do not need to test cell phones at body contact and it is proven that phones will create exposure that are higher than FCC limits when phones are tested in these positions.*

The Telecommunications Act of 1996 directs the FCC to establish rules regarding radiofrequency (RF) exposure. The U.S. Food and Drug Administration (FDA) sets standards for electronic devices that emit non-ionizing or ionizing radiation. The EPA defers to these regulatory authorities for the establishment of safe levels of radiofrequency radiation.

8. *The FDA and FCC have been provided with information and published data showing the fact that cell phones create cell phone radiation exposures that violate FCC limits. What agency has the job of ensuring accountability that the American public is not exposed to RF radiation that exceeds FCC limits. The FCC has test protocols that say body contact tests are not needed. The FDA refers to the FCC. Yet the fact is that cell phones exceed FCC limits when tested in body contact positions. Are the FCC limits legitimate? These FCC limits are being violated. Who is the responsible agency that will ensure Americans are protected? The FCC says their rules are not being violated as their rules allow for a space between the phone or device and the body? The FDA says there is a safety factor so there is no need for them to act (and will not state what the safety factor for a cell phone is) . YET government limits are being exceeded. Are agencies fine with limits being violated? If so please explain at what level of cell phone radiation a federal agency will step in? If so, which agency has jurisdiction? (March 12, 2019 [Publication on Om Gandhi's paper](#) on radiation emissions violating FCC limits 11 times and August 21, 2019 [Chicago Tribune cell phone testing data released](#))*

EPA Response: The Telecommunications Act of 1996 directs the FCC to establish rules regarding radiofrequency (RF) exposure. The U.S. Food and Drug Administration (FDA) sets standards for electronic devices that emit non-ionizing or ionizing radiation. The EPA does not have a funded mandate for radiofrequency matters, and the questions you raise are outside of EPA's areas of responsibilities and current expertise. Please refer this question to the FCC and FDA.

9. *The National Toxicology Program states clear evidence of cancer was found and the FDA disputes this because it was just an animal study.*

However birds fly and nest on cell antennas mounted on towers, bees fly in front of antennas and family pets (dogs, cats) will sit directly on or near Wi-Fi routers and smart speakers despite the fact that the manuals state humans should be at a minimum of 20 cm from wireless devices (far more from antennas of towers). What about the impact on these animals? What is the US government doing to ensure safety for wildlife and family pets?

EPA Response: The EPA does not have a funded mandate for radiofrequency matters, and the questions you raise are outside of EPA's area of responsibility and current expertise. We defer to FDA to provide a response regarding their findings.

10. *Please send me the staff member of your respective agency who is on the Interagency Radiofrequency Workgroup as I have repeatedly tried to get this information and it is never provided to me.*

EPA Response: The Radiofrequency Interagency Work Group (RFIAWG) is an informal forum for exchange of information and the group does not meet to set, or advise on, policy, rulemaking or guidance. The group has not met in more than two years.

11. *The FDA only reviewed selected studies on cancer until 2018. Most recently, the American Cancer Society funded radiation in people with genetic susceptibilities. The National Toxicology Program published [research](#) showing DNA damage. Will the FDA be updating it's review with these studies? If not, then what agency is accountable to American public to ensure humans are not harmed?*

EPA Response: The questions you raise are outside of EPA's areas of responsibilities and current expertise. Please direct questions about FDA activities to FDA.

12. *What agency ensures safety related to extremely low frequency (ELF-EMF) electromagnetic fields- also non ionizing? Currently we have no federal limit, no federal guidelines and confirmed associations with cancer and many other health effects. Kaiser Permanente researchers have published several studies linking pregnant women's exposure to magnetic field electromagnetic fields to not only increased [miscarriage](#) and but also increased [ADHD](#), [obesity](#) and [asthma](#) in the*

woman's prenatally exposed children. A recent [large scale study](#) again found associations with cancer. Please clarify which US agency has jurisdiction over ELF-EMF exposures?

EPA Response: There are no U.S. Federal standards limiting residential or occupational exposure to electric and magnetic fields (EMF) from power lines. The EPA does not have a funded mandate for radiofrequency matters.

13. When it comes to cell phone radiation SAR thresholds, what is your understanding of the "safety factor" in place?

EPA Response: EPA last commented on FCC proposals for SAR limits in the 1996 [FCC 96-236](#). The Telecommunications Act of 1996 directs the FCC to establish rules regarding radiofrequency (RF) exposure. The U.S. Food and Drug Administration (FDA) sets standards for electronic devices that emit non-ionizing or ionizing radiation. The EPA defers to these regulatory authorities for the establishment of safe levels of radiofrequency radiation.

Sincere regards,
Lee Ann B. Veal
Director, Radiation Protection Division
Office of Radiation and Indoor Air
www.epa.gov/radiation

Smarter, Safer Energy Savers

Smart thermostats and other WiFi-connected energy-savers are all the rage. But do you need them to cut your home energy use?

DID YOU KNOW...

ENVIRONMENTAL HEALTH TRUST

YOU LOVE YOUR WI-FI, BUT YOUR WI-FI DOES NOT LOVE YOU.

Wireless radiation is linked to cancer, oxidative stress, brain cell damage, and damage to sperm. For safe connections, use corded landlines for phone calls and corded Ethernet cables for internet.

EHTrust.org

#PracticeSafeTech



there are three different types of EMF radiation: extremely low frequency EMFs, like those emitted by electrical wiring and corded devices. On the other end of the spectrum are high-frequency EMFs like X-ray and gamma-ray radiation that are known to damage DNA, which can lead to cancer.

In the middle, you have radio-frequency EMFs, which are emitted by wireless networks, smart meters, cordless phones, and cell phones.

These wireless devices may harm human health, says Dr. Devra Davis, a scientist who is the executive director of Environmental Health Trust, lectures at top universities and medical schools, and literally wrote the book on cell phones and EMFs: *Disconnect: The Truth About Cell Phone Radiation, What the Industry Has Done to Hide It, and How to Protect Your Family* (Dutton, 2010).

“All wireless devices from smart-phones to wireless laptops to baby monitors come with FCC warnings that they are not safe to use if held directly on the body because the radio frequency emissions can exceed government limits,” says Davis. “There is a growing body of experimental evidence showing that cell phone and wireless radiation may be linked to miscarriages in pregnant women, lower sperm counts, increased brain tumors, and more changes in blood markers that can lead to inflammatory conditions like arthritis and cancer.”

Cell phone and wireless radiation are the same type of radiation, says Davis. But cell phones are more of a worry since most people place them directly next to their heads, and they probably aren’t going to lie on their wireless routers any time soon.

“Every millimeter away gives you 15 percent less radiation,” says Davis.

But, she notes, wireless devices in close proximity to our bodies may still expose us to unhealthy amounts of EMF radiation: “For many smart tech

The popularity of smart thermostats is on the rise. Devices like Google’s Nest use a feature called “geo-fencing” to use sensors in your home and the signal on your mobile phone to turn themselves to an eco-friendly lower setting while you’re away. Some take a few days to learn your heating and cooling habits, then adjust your thermostat accordingly while you’re in your house or apartment, or will allow you to program and schedule settings. Many will give you regular reports on how much energy you’re saving and send you warnings if the temperature ever plummets to the point where a pipe could burst.

You can also find smart lighting that you can dim, brighten, shift colors, and turn on and off via an app. Or smart switches that allow you to turn the devices they’re connected to on and off, program them to a timer, or even check for “phantom load” power leaks (energy that drains from a device when it’s turned off) via an app. And then there

are full-house monitors that connect to your breaker box and monitor your energy use all throughout your home, generating energy-use reports and pinpointing energy drains (say it with us) via an app.

Sounds nifty, right? But nearly all the new energy-saving tech Green America’s editorial team found requires a wireless connection. And, say many experts, wireless devices may not be the healthiest things you can bring into your home.

The good news is, you can cut your home energy use by 50 percent or more without wireless.

EMF Radiation and Health

Back in 2011, the *Green American* sounded a warning about EMF radiation, particularly that emitted from cell phones, since people hold them close to their heads and bodies.

EMF radiation is produced by electricity as it moves through a wire. The National Cancer Institute notes that

devices, whether it's a dryer, fridge, washing machine, we don't even know where the wireless components are implanted. We don't know where they're located, how often they're on." And that, she says, could be a problem.

EMF Warnings Abound

In recent years, more and more respected bodies have issued warnings on wireless and cell phone radiation, particularly with children, whose bodies absorb more of it than adult bodies do.

In mid-2010, the World Health Organization classified radio-frequency radiation from cell phones, wireless, and other devices, as a "possible human carcinogen," the same category into which it places jet fuel and lead.

In 2011, researchers from the National Institutes for Health released a study that linked exposure to low levels of wireless radiation to changed brain activity.

In 2011, scientists at Yale University found increased levels of hyperactivity and memory problems in mice exposed to wireless radiation *in utero*. Shortly thereafter, Yale and Harvard issued warnings to pregnant women reduce their exposure to wireless radiation.

In 2012, scientists working at Kaiser Permanente published an article in *Scientific Reports* after finding pregnant women exposed to "real-world" levels of radio-frequency radiation had nearly three times more miscarriages than women who weren't exposed.

The countries of Belgium, France, Australia, Russia, the UK, India, Finland, Turkey, Canada, and the European Union have all taken measures to reduce children's exposure to wireless and cell phone radiation.

In December 2017, the state of California issued guidelines to help reduce children's exposure to wireless and cell phone radiation.

And in February, the National Toxicology Program released the results of a multi-year study on mice and rats. It found that male rodents exposed to high levels of EMF radiation grew rare, malignant tumors in the brain and heart.

"Genome research shows that humans differ genetically from rats by three percent," says Davis. "Every agent that we know causes cancer in humans will also produce it in animals

when adequately studied."

In addition, Davis points out that the fine print in most cell phone user manuals generally warn people to keep the phones at least an inch from your head, and away from pregnant women.

Save Energy Without Wireless

While new technology can make saving energy easier to do from your couch, it's very possible to drastically cut your home energy use without it.

In our 2010 *Efficiency First!* issue, we laid out techniques for improving your home efficiency by 50 percent. Find our handy, updated infographic to help you do so online at greenamerica.org/RESTOFURL/.

For example, you can easily find an inexpensive, non-wireless programmable thermostat. Just programming your thermostat to heat or cool less when you're away or sleeping can cut your home energy use by ten percent.

You don't need smart switches to remind you to turn off the lights. Download our switchplate sticker at greenamerica.org/RESTOFURL/ to remind your household to avoid lighting up rooms when you're not in them.

And you can check for phantom load energy leaks with a Kill-a-Watt meter, which will measure the energy drain of devices and appliances you plug into it.

For a more comprehensive take on plugging energy leaks, call in a Home Performance with ENERGY STAR auditor (energystar.gov), who will pinpoint areas where your home is wasting energy and give you suggestions to fix them, in addition to flagging indoor-air pollution sources.

For a DIY approach to an audit, the free Homeselfe app (iOS, *Android: homeselfe.com*) takes you step-by-step through your home, asking you questions about your energy use, then generates recommendations to help you make your home more energy efficient. It even connects you with local energy rebates for which you may be eligible.

Finally, installing LED bulbs uses 75 percent less energy than incandescent bulbs, and the average US home will save over \$1,000 over a ten-year period, according to a 2017 cost analysis by the Consumer Federation of America.

—Tracy Fernandez Rysavy

EMF SAFETY TIPS

Use these tips from Environmental Health Trust (ehtrust.org) to keep yourself and your family safe from cell-phone and wireless radiation:

- **Exercise caution with children**, whose smaller bodies absorb more EMF radiation than adults do.
- **Distance is your friend.** The amount of radiation the human body absorbs decreases by 15 percent with every millimeter away from the wireless device. Keep devices away from the body and your bedroom. And put devices on a table or desk, not your lap.
- **Use the speakerphone setting** on your cell phone instead of holding it against your head, or use a headset. (Corded headsets are best, but a Bluetooth headset is better than putting the phone near your face.)
- **Avoid carrying your cell phone in a pocket or bra.** Carry it in a bag with the back facing away from you.
- To keep your phone or device from emitting any radiation, **turn off the WiFi and Bluetooth settings and put it in airplane mode** when you don't need to be online.
- If you use your phone as an alarm clock, **put it in airplane mode.**
- **Hard-wire devices** that connect to the Internet whenever possible.
- If you can't hard-wire your home, **turn off wireless routers at night.**
- **Use corded phones** when possible. Cordless phones still emit EMF radiation, but it's much less than that emitted by cell phones.
- **Keep an eye on your signal strength.** The weaker the signal, the more radiation your device emits, as it's working harder.
- **Avoid making calls while traveling in a motor vehicle or elevator.** The phone works harder to get a signal through metal, so it emits more radiation.
- **Never give a cell phone to young children** that still put toys in their mouths.
- **Reinforce the message with teens**, who often sleep with their phones or carry them in a pocket.

Scientific and Policy Developments in Radiofrequency Radiation

December 2019 through November 29, 2021

Selected Research Publications Showing Adverse Effects Since the FCC Issued its Determination December 2019 Not to Update its 1996 Standards for Evaluating Wireless Radiation from Cell Phones, Electronic Devices and Networks

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New Scientific and Policy Developments in Radiofrequency Radiation

A Sampling of Research Publications Showing Adverse Effects Since the FCC Issued its Determination Not to Update its 1996 Standards for Evaluating Wireless Radiation from Cell Phones, Electronic Devices and Networks

More than 75 new important scientific developments, expert reports and recommendations have been published since the FCC issued its determination to not initiate a rulemaking proceeding to update its regulatory limits for human exposure to wireless radiofrequency radiation (RFR) in December 2019.

This report showcases a small sampling of the last two years of scientific publications that have documented adverse effects of RFR exposure. Studies include impacts to wildlife and the environment, the unique vulnerability of children and the fetus, DNA damage, oxidative stress, nervous and reproductive system impacts and brain development. New experimental and epidemiological evidence for cancer tied to RFR has been published as well as papers detailing how cancers can arise from non-ionizing radiation.

Further, recent publications have documented significant health and environmental implications arising from 5G network related millimeter wave frequencies and all current and new wireless air interfaces' use of modulation, pulsation and other waveform manipulation. Wireless telecommunications signals are complex and FCC regulations do not address the biological impact of different modulations nor consider the numerous unique characteristics of real world telecommunication signals. We highlight how new landmark papers document the science indicating the urgent need to consider modulation and pulsation, rather than simply power density.

The evidence is now clear that RF emissions within the Commission's guidelines have significant negative adverse biological effects.

WILDLIFE/ENVIRONMENT

The FCC's current FCC radiofrequency radiation (RFR) emissions limits apply to human exposures. They do not address wildlife, plants or trees. Birds perch and nest on cell towers. Bats and bees and other airborne species occupy air space in close proximity to transmitting cell antennas. Wireless network densification increases RFR levels ([El-Hajj & Naous, 2020](#)) and with over [800,000 new cell sites](#) projected¹ for the 5G buildout, environmental effects need to be properly examined because ambient RFR is [increasing](#) in wildlife habitat.

A landmark three-part research review on effects to wildlife was published in *Reviews on Environmental Health in 2021* by U.S. experts, including former U.S. Fish and Wildlife senior biologist Albert Manville. The authors reviewed and cited more than 1,200 scientific references. These experts concluded that the evidence was adequate to trigger urgent regulatory action. The review found adverse biological effects to wildlife from even very low intensity non-ionizing

¹ [Remarks of FCC Chairman Ajit Pai White House 5G Summit Washington DC, September 28, 2018](#)

radiation emissions at multiple orders of magnitude below current FCC-allowed levels ([Levitt et al., 2021a](#), [Levitt et al., 2021b](#), [Levitt et al., 2021c](#)).

Comprehensive documentation of the biological effects of non-ionizing electromagnetic radiation to flora and fauna has never before been undertaken to this degree in any previous publication. These three experts divide their science and findings with urgent warnings into three parts: **Part 1** identifies ambient EMF adverse effects on wildlife, and notes a particular urgency regarding millimeter wave emissions and the pulsation/modulation used in 5G technologies. **Part 2** explores natural and man-made fields, animal magnetoreception mechanisms, and pertinent studies to all wildlife kingdoms. **Part 3** examines current exposure standards, applicable laws, and future directions. Their conclusions after this expansive review of the science are neither equivocal nor speculative. This environmental research review is a clarion call to develop regulations that ensure wildlife and its habitat are protected. The abstract summarizes the findings:

“Numerous studies across all frequencies and *taxa* indicate that low-level EMF exposures have numerous adverse effects, including on orientation, migration, food finding, reproduction, mating, nest and den building, territorial maintenance, defense, vitality, longevity, and survivorship. Cyto-toxic and geno-toxic effects have long been observed. It is time to recognize ambient EMF as a novel form of pollution and develop rules at regulatory agencies that designate air as ‘habitat’ so EMF can be regulated like other pollutants. Wildlife loss is often unseen and undocumented until tipping points are reached. A robust dialog regarding technology’s high-impact role in the nascent field of electroecology needs to commence. Long-term chronic low-level EMF exposure standards should be set accordingly for wildlife, including, but not limited to, the redesign of wireless devices, as well as infrastructure, in order to reduce the rising ambient levels.”

Numerous individual studies on impacts to flora and fauna have been published over the last two years, notably several on pollinators and insects.

Two studies used scientific simulations to quantify the amount of power absorbed into the bodies of various insects for different RFR frequencies. In January 2020 researchers published “Radio-frequency electromagnetic field exposure of Western Honey Bees” in *Scientific Reports* on the absorption of RFR into honey bees at different developmental stages with phantoms simulating worker bees, a drone, a larva, and a queen ([Thielens et al., 2020](#)). The simulations were combined with measurements of environmental RF-EMF exposure near beehives in Belgium in order to estimate realistic exposures. They found absorbed RF-EMF power increases by factors of up to 16 to 121 when the frequency is increased from 0.6 GHz to 6 GHz for a fixed incident electric field strength. The implications of the impacts to such an ecologically and economically important insect species bees would be widespread and consequential.

In October 2021 a second simulation study with far-reaching implications [“Radio-frequency exposure of the yellow fever mosquito \(*A. aegypti*\) from 2 to 240 GHz”](#) published in *PLOS Computational Biology* simulated the far field exposure of a mosquito

between 2 and 240 GHz and found power absorption is 16 times higher at 60 GHz than at 6 GHz at the same incident field strength. This increase is even larger (by a factor of 21.8) for 120 GHz when compared to 6 GHz. The authors conclude “higher absorption of EMF by yellow fever mosquitoes, which can cause dielectric heating and have an impact on behaviour, development and possibly spread of the insect.”

In 2020, a [report by Alain Hill](#) of the biological effects of non-ionizing radiation on insects found that mobile communications were a critical factor in weakening the insect world along with pesticides and habitat loss. ([Khan et al., 2021](#)) found the Apis Cerana bee becomes very passive at a certain level of frequencies and power.

In May 2021, biologistb Alfonso Balmori published “[Electromagnetic radiation as an emerging driver factor for the decline of insects](#)” in *Science of The Total Environment*. *concluding* that electromagnetic radiation threatens insect biodiversity worldwide. He documents sufficient evidence of non-thermal, effects of non-ionizing radiation on insects at levels well below the limits allowed by FCC guidelines, and warns that action must be taken now before significant deployment of new technologies (like with 5G) is undertaken. He cautions that the loss of insect diversity and abundance will likely provoke cascading effects on food webs and ecosystem services.

A November 2021 review of the effects of millimeter waves, ultraviolet, and gamma rays on plants found many non-thermal effects specifically from millimeter waves ([Zhong et al. 2021](#)). (The paper examined the millimeter range 30 to 300 GHz which overlaps with FCC’s limits 300 kHz to 100 GHz.) Millimeter-wave irradiation stimulated cell division, enzyme synthesis, growth rate, and biomass. The review highlights how different doses and durations provoked dynamic morphophysiological effects in plants. Seed pretreatment with weak microwaves or millimeter wave irradiation altered root physiology. Different effects were observed in different plants and the authors state that, “the discordance of proteomic changes in different plants is reasonable, since different plants have a distinct tolerance to stress. Moreover, the cell tissues from soybeans and chickpeas used for proteomic analysis were different, which implies that tissue-specific or organ-specific responses of plants under millimeter-wave irradiation might exist and require further investigation.” This review adds to the published analysis confirming non thermal effects from RFR. While these frequencies may have beneficial uses in agriculture, the adverse impact to trees and plants in close vicinity to transmitting antennas must be addressed.

CHILDREN

Children are proportionally more exposed to RF-EMF than adults because their brain tissue is more conductive, their skulls are thinner, and their bodies are smaller. Children are known to be at greater risk than adults when exposed to any carcinogen because of their rapidly dividing cells. Because the average latency time between first exposure and diagnosis of a tumor can be decades, tumors induced in children from RFR may not be diagnosed until adulthood. Even more importantly, children and the developing fetus are more vulnerable to RFR because their brains and organs are still developing and more sensitive. Research over

the last two years has added critical new science on children's vulnerability to health impacts from RFR and supports the acute need to reduce exposures..

To start, the Environmental Working Group published a landmark study in *Environmental Health* analyzing the findings of increased tumors and heart damage from the National Toxicology Program study and concluded that FCC limits should be strengthened by 200 to 400 times to protect children according to current risk assessment guidelines ([Uche, 2021](#)). “The analysis presented here supports a whole-body SAR limit of 2 to 4 mW/kg for adults, an exposure level that is 20- to 40-fold lower than the legally permissible limit of 0.08 W/kg for whole-body SAR under the current U.S. regulations. A ten-fold lower level of 0.2–0.4 mW/kg whole-body SAR may be appropriate for young children. Both technology changes and behavior changes may be necessary to achieve these lower exposure levels. Simple actions, such as keeping the wireless devices farther away from the body, offer an immediate way to decrease RFR exposure for the user.”

([Cabr -Riera et al., 2020](#)) investigated RFR doses in preadolescents at 9 – 12 years old. In “Estimated whole-brain and lobe-specific radiofrequency electromagnetic fields doses and brain volumes in preadolescents” published in *Environment International* the authors reveal their findings that although whole-brain and lobe-specific RF-EMF doses from all RF-EMF sources together, from mobile and DECT phone calls and far-field sources were not associated with global, cortical, or subcortical brain volumes, a higher whole-brain RF-EMF dose from mobile phone use for internet browsing, e-mailing, text messaging, tablet use, and laptop use while wirelessly connected to the internet was indeed associated with a smaller caudate volume. The caudate nucleus plays an important role in procedural learning, associative learning and inhibitory control of action and it is also one of the brain structures comprising the reward system. Analysis of cognitive impacts in another analysis ([Cabr -Riera et al., 2020](#)) found higher overall whole-brain RF-EMF doses from all RF-EMF sources together and from phone calls were associated with lower non-verbal intelligence score in Dutch and Spanish preadolescents.

Yet another publication by the same group ([Cabr -Riera et al., 2021](#)) investigated the association of estimated all-day and evening whole-brain radiofrequency electromagnetic field (RF-EMF) doses with sleep disturbances and objective sleep measures in preadolescents. The researchers, publishing their findings in *Environmental Research*, found preadolescents with high evening whole-brain RF-EMF dose from phone calls had a shorter total sleep time compared to preadolescents with zero evening whole-brain RF-EMF dose from phone calls.

A 2020 research review from the Department of Pediatrics, Hanyang University School of Medicine, Seoul, Korea ([Moon, 2020](#)) recommends precaution and minimizing EMF exposure to children, cautioning that the nervous systems of children are more vulnerable to the effects of electromagnetic waves than those of adults.

PREGNANCY

Using a mobile phone for calls for more than 30 minutes per day during pregnancy was associated with a negative impact on fetal growth ([Boileau et al., 2020](#)). Mobile phone use during pregnancy was associated with night-wake of infants ([Weng et al., 2020](#)). ([Bektas et al., 2020](#)) concluded that mobile phone exposure during pregnancy could cause oxidative stress and DNA damage in cord blood and placenta. Finally, the combined effects of Wi-Fi plus mobile phone exposure could have a higher potential to cause synergistic effects.

Recent animal research includes a study that found Wi-Fi signals increase lipid peroxidation, SOD activity (oxidative stress), apoptosis and CDKN1A and GADD45a overexpression in mice placenta tissue ([Vafaei et al., 2020](#)). A study on pregnant rats found damage to cells in the cerebellum. The authors conclude that prenatal mobile phone radiation might lead to the damage of axon, the nerve fiber, and myelin, the sheath that forms around nerves, with activity of astrocytes in cerebellum of male rat offspring ([Yang et al., 2020](#)).

CHARACTERIZING RFR EXPOSURES DURING CHILDHOOD AND PREGNANCY

Current FCC exposure levels were set in 1996 without a complete understanding of how RFR is absorbed into the fetus, pregnant women or children. Research published in 2020 and 2021 adds critical new data regarding these exposures. For example, ([Foroutan et al., 2020](#)) studied the absorption of WiFi and LTE frequencies into a 43-year-old pregnant woman model carrying a 24-week baby to allow scientists to better understand health impacts due to the interaction between electromagnetic fields and human tissue. ([Psenakova et al., 2020](#)) states “numerical results have shown that the obtained maximal SAR values in AustiWoman model is higher than are maximum values determined according to maximum SAR in European standards limit.”

In “Electromagnetic Field in Vicinity of Electronic Baby Monitor” published by IEEE, ([Gombarska et al., 2020](#)) found exposures from a baby monitor to be regulation-compliant but the authors warn, “Some caution should be exercised when using such devices, in particular regarding keeping a safe distance from the little children.” These and other new studies confirm the urgent need to reduce exposures, especially for children and pregnant women.

FERTILITY

Environmental Research published “A meta-analysis of in vitro exposures to weak radiofrequency radiation exposure from mobile phones (1990–2015)” describing 1127 experimental observations in cell-based in vitro models on RFR. It found less differentiated cells such as epithelium and spermatozoa are more sensitive to RF ([Halgamuge et al., 2020](#)). This study also confirms observations from the REFLEX project, Belyaev and others that cellular response varies with signal properties.

Several reviews on RFR impacts to sperm and reproduction were published over the last two years analyzing the body of evidence. A systematic review and meta-analysis ([Sungjoon et al., 2021](#)) evaluated 18 studies and found exposure to mobile phones is associated with reduced sperm motility, viability and concentration. ([Yu et al., 2021](#)) found mobile phone RFR exposure could decrease the motility and viability of mature human sperm *in vitro* and the pooled results of animal studies showed that mobile phone RF-EMR exposure could suppress sperm motility and viability. A systematic review on the effects of RFR to male reproductive hormones ([Maluin et al., 2021](#)) found that wireless can impact testosterone. The authors detail how testes are one of the most vulnerable organs to RF-EMR. Testicular tissues are more susceptible to oxidative stress due to a high rate of cell division and mitochondrial oxygen consumption.

([Okechukwu, 2020](#)) reviewed human and animal studies published from 2003 to 2020 investigating RFR from cell phones and male fertility, publishing their findings “Does the Use of Mobile Phone Affect Male Fertility? A Mini-Review” in *Journal of Human Reproductive Sciences*. They found evidence in both animal and human spermatozoa of reduced motility, structural anomalies, and increased oxidative stress due to overproduction of reactive oxygen species after RFR exposure. The authors assert that scrotal hyperthermia and increased oxidative stress might be the key mechanisms through which EMR affects male fertility.

As an example of the experimental studies published over the last two years, an animal study on 4G found kidney inflammation and damage to the testes in mice ([Hasan et al., 2021](#)). The researchers concluded that fourth-generation cell phone radiation exposure may affect blood hemostasis and inflammation of mice's kidney and testis tissue and they warn that “based on these studies, it is important to increase public consciousness of potential adverse effects of mobile phone radiofrequency electromagnetic radiation exposure.”

([Hassanzadeh-Taheri et al., 2021](#)) assessed the effects of cell phone RFR on sperm parameters, DNA fragmentation, and apoptosis in normozoospermic and found higher apoptotic sperms and DNA fragmentation in the RFR exposed. The authors conclude: “it is recommended to keep the cell phone away from the pelvis as much as possible.”

ELECTROSENSITIVITY

The International Journal of Molecular Sciences published “Electrohypersensitivity (EHS) as a Newly Identified and Characterized Neurologic Pathological Disorder: How to Diagnose, Treat, and Prevent It” ([Belpomme & Irigaray, 2020](#)). This paper documents the data and shows EHS is a neurologic pathological disorder which can be diagnosed, treated, and prevented. Utilizing a database of over 2000 electrohypersensitivity (EHS) and/or multiple chemical sensitivity (MCS) self-reported cases, they found EHS can be clinically characterized by a similar symptomatic picture to multiple chemical sensitivity by low-grade inflammation and an autoimmune response involving autoantibodies against O-myelin. According to the authors: “80% of the patients with EHS present with one, two, or three detectable oxidative stress

biomarkers in their peripheral blood, meaning that overall these patients present with a true objective somatic disorder.”

“The Critical Importance of Molecular Biomarkers and Imaging in the Study of Electrohypersensitivity. A Scientific Consensus International Report” in the *International Journal of Molecular Sciences* is a scientific consensus international report authored by 32 scientists. They call for the acknowledgement of electrohypersensitivity as a distinct neuropathological disorder and for inclusion in the WHO International Classification of Diseases (*e.g.*, distinct from the current grouping within other ICD codes addressing exposure to non-ionizing radiation) ([Belpomme et al., 2021](#)). The paper presents the French teams’ EHS/MCS physiopathological model based on low-grade neuroinflammation and oxidative/nitrosative stress-induced blood–brain barrier disruption, which attempts to account for the mechanisms through which pathophysiological effects could take place in the brain of EHS and/or MCS patients and how EHS and/or MCS pathogenesis may consequently occur. The paper also documents the methodological defects that make provocation tests unsuitable for sham versus EMF exposure analysis in EHS-bearing patients. The paper documents how EHS patients’ RFR exposure has been found to increase plasma glucose levels, affect heart rate variability and in multiple sclerosis-bearing patients RFR exposure can worsen symptoms, meaning that RFR can induce objective, bioclinical alterations in humans.

BRAIN/NEUROLOGY

([Hasan et al., 2021](#)) found long-term exposure to 2400 MHz 4G impacted the structural integrity of the hippocampus and increased anxiety-like behavior in mice. ([Hu et al., 2021](#)) published “Effects of Radiofrequency Electromagnetic Radiation on Neurotransmitters in the Brain” in *Frontiers in Public Health*, offering a review that summarizes the effects of EMR on the neurotransmitters in the brain. The nervous system is an important target organ system and is sensitive to EMF. They document research that suggests that long-term exposure to EMR may lead to abnormal norepinephrine and epinephrine contents in the brain, metabolic disorders of monoamine neurotransmitters in the brain and excitatory amino acid neurotransmitters in the hippocampus, “which may affect the excitatory-inhibitory balance of neurons, thus causing a decline in learning and memory ability.” The authors also considered the underlying mechanism as “EMR exposure does increase the intracellular calcium and the formation of ROS, which would alter the cellular function eventually and lead to numerous biological effects including neurotransmitter imbalance.” The authors call for more research to clarify effects.

A systematic review ([Bertagna et al., 2021](#)) published in *Annals of the New York Academy of Sciences* found that neuronal ion channels are particularly affected by EMF exposure. Changes in calcium homeostasis, attributable to the voltage-gated calcium channels, were the most commonly reported result of EMF exposure. EMF effects on the neuronal landscape appear to be diverse and greatly dependent on parameters like the field's frequency, exposure time, and intrinsic properties of the irradiated tissue, such as the expression of VGCs. The researchers systematically clarify how neuronal ion channels are particularly affected and differentially modulated by EMFs at multiple levels, such as gating dynamics, ion conductance,

concentration in the membrane, and gene and protein expression. Ion channels represent a major transducer for EMF-related effects on the CNS.

([Tan et al., 2021](#)) evaluated the acute effects of 2.856 GHz and 1.5 GHz microwaves to male rats and found exposures induced a decline in spatial memory.

“Exposure of Radiofrequency Electromagnetic Radiation on Biochemical and Pathological Alterations” in *Neurology India* ([Sharma et al., 2020](#)) found 800 MHz frequency at a SAR of 0.433 W/kg in male Wistar rats led to neurochemical and pathophysiological damage by initiating the inflammatory process in various brain regions, especially in hippocampus and cerebral cortex. The authors conclude that since the hippocampus involves storing and retaining information during the learning process, RFR exposure negatively affects the memory and learning process and “could be a huge risk of induction of brain damage.”

([Hinrikus et al., 2021](#)) review “Threshold of radiofrequency electromagnetic field effect on human brain” in the *International Journal of Radiation Biology* found the threshold for EEG effects is far lower than the level deemed safe by the U.S. FCC. The lowest level of RF EMF at which the effect in EEG was detected is 2.45 V/m (SAR = 0.003 W/kg). The authors state the changes in EEG caused by RF EMF appeared similar in the majority of analyzed studies and similar to those found in depression. They conclude that the “possible causal relationship between RF EMF effect and depression among young people is [a] highly important problem.”

([Luo et al., 2021](#)) in their paper “Electromagnetic field exposure-induced depression features could be alleviated by heat acclimation based on remodeling the gut microbiota” published in *Ecotoxicology and Environmental Safety* share their findings that pulsed electromagnetic fields (2450 MHz) caused gut microbiota and metabolites disturbance similar to depression model. “In our study, EMF induced disturbance in the metabolite profiles of serum samples. Significantly different metabolites included cholesterol, D-fructose and fumaric acid and these were associated with depression ([Xiong et al., 2020](#)). Based on KEGG classification, the metabolites involved in [neurotransmitters](#) and steroids were altered significantly.”

They concluded that “our study demonstrated that EMF exposure could not only lead to neurobehavioral disorders such as depression, but also cause gut microbiota imbalance.” The researchers also referenced how “growing evidence indicates that the gut microbiota affects not only gastrointestinal function but also central nervous system (CNS) physiology and behavior by regulating the microbiota-gut-brain axis.”

OXIDATIVE STRESS

More recently published studies demonstrate consistency for the induction of oxidative stress. Oxidative DNA damage can lead to mutations, chromosomal translocations, and genomic instability, which are cellular events that can result in cancer development. Induction of oxidative stress, which is a key characteristic of many human carcinogens including ionizing radiation and asbestos, may also lead to the genotoxicity and carcinogenicity of non-ionizing

RFR. Oxidative stress caused by EMFs is thought to be due to the altering of recombination rates of short-lived radical pairs leading to increases in free radical concentrations. Thus, even without causing direct DNA damage, RFR may induce oxidative DNA damage and thereby initiate or promote tumor development.

([Schuermann & Mevissen, 2021](#)) published a major review on oxidative stress, “Manmade Electromagnetic Fields and Oxidative Stress – Biological Effects and Consequences for Health” in *International Journal of Molecular Sciences*. The authors found increased oxidative stress in the majority of animal studies and cell studies, many with exposures compliant with FCC and ICNIRP regulatory limits. Increased oxidative stress caused by RF-EMF and ELF-EMF were reported in the majority of the animal studies and in more than half of the cell studies. Investigations in Wistar and Sprague-Dawley rats provided consistent evidence for oxidative stress occurring after RF-EMF exposure in the brain and testes and some indication of oxidative stress in the heart. Observations in Sprague-Dawley rats also seem to provide consistent evidence for oxidative stress in the liver and kidneys. “A trend is emerging, which becomes clear even when taking these methodological weaknesses into account, i.e., that EMF exposure, even in the low dose range, may well lead to changes in cellular oxidative balance.” The authors explain that pre-existing conditions like diabetes and neurodegenerative diseases compromise the body’s defense mechanisms, including antioxidant protection processes, and individuals with pre-existing conditions are more likely to experience health effects. Further, very young or old individuals can react less efficiently to oxidative stress. This puts them at greater risk of health impacts.

“Effects of different mobile phone UMTS signals on DNA, apoptosis and oxidative stress in human lymphocytes” ([Gulati et al., 2020](#)) published in *Environmental Pollution* comparatively analyzed genotoxic effects of UMTS signals at different frequency channels used by 3G mobile phones (1923, 1947.47, and 1977 MHz) and found a relatively small but statistically significant induction of DNA damage in dependence on UMTS frequency channel with maximal effect at 1977.0 MHz, supporting the notion that each specific signal used in mobile communication should be tested.

“Effects of pulse-modulated radiofrequency magnetic field (RF-EMF) exposure on apoptosis, autophagy, oxidative stress and electron chain transport function in human neuroblastoma and murine microglial cells” published by ([Zielinski et al., 2020](#)) in *Toxicology in Vitro* investigated the effects of ELF-modulated 935 MHz RF-EMF on apoptosis, autophagy, oxidative stress and electron exchange in human neuroblastoma and murine microglial cells. The authors found effects indicating that “short-time RF-EMF at SAR levels accepted by today's safety guidelines might cause autophagy and oxidative stress with the effect being dependent on cell type and exposure duration. Further studies are needed to evaluate possible underlying mechanisms involved in pulse-modulated RF-EMF exposure.”

([Singh et al., 2020](#)) exposed male Wistar rats to RFR for 16 weeks (2 h/day) and observed oxidative stress, an inflammatory response, and HPA axis deregulation. “Effect of mobile phone radiation on oxidative stress, inflammatory response, and contextual fear memory

in Wistar rat” was published in *Environmental Science and Pollution Research International*. The study shows that chronic exposure to MP-RF-EMF radiation emitted from mobile phones may induce oxidative stress, inflammatory response, and HPA axis deregulation.

([Hussien et al., 2020](#)) found a significant decrease in plasma nesfatin-1 level and thyroid functions with an increase in oxidative stress and apoptosis. Further, there was a correlation between nesfatin-1 level and markers of thyroid function, oxidative stress and apoptosis. The researchers conclude that Nesfatin-1 plays a role in thyroid dysfunctions of rats exposed to mobile phone radiation. The authors’ “Decreased level of plasma nesfatin-1 in rats exposed to cell phone radiation is correlated with thyroid dysfunction, oxidative stress, and apoptosis” published in *Archives of Physiology and Biochemistry* details these findings.

GENOTOXICITY/ DNA DAMAGE

Major studies using validated experimental protocols published in 2020 and 2021 associate non-ionizing RFR exposure with DNA damage.

In February 2020, U.S. government scientists published landmark findings of “significant increases in DNA damage” in groups of male mice, female mice and male rats after just 14 to 19 weeks of non-thermal cell phone RFR exposure as part of the large scale National Toxicology Program cell phone animal studies ([Smith-Roe et al., 2020](#)). “Evaluation of the genotoxicity of cell phone radiofrequency radiation in male and female rats and mice following subchronic exposure” published in *Environmental and Molecular Mutagenesis* details the much-anticipated results of the comet assay showing significant increases in DNA damage in the frontal cortex of male mice (both modulations), leukocytes of female mice (CDMA only), and hippocampus of male rats (CDMA only). Increases in DNA damage judged to be equivocal were observed in several other tissues of rats and mice. “In conclusion, these results suggest that exposure to RFR is associated with an increase in DNA damage.” In short, DNA damage was found at non-thermal RFR levels, levels the FCC regulatory limits presume are harmless.

The authors explain that the NTP studies were designed to evaluate non-thermal effects of cell phone RFR exposure, which meant that body temperature could not change more than 1° C and therefore the NTP scientists considered it unlikely that thermal effects were a confounding factor for these genetic toxicity tests. Thus, this data again adds to the large body of evidence confirming that the assumption that non-ionizing radiation does not cause any adverse health effects other than by heating is wrong. The study is a game changer because the NTP exposures were carefully controlled and NTP studies are considered the gold standard in animal testing.

In “Genetic effects of non-ionizing electromagnetic fields” published in *Electromagnetic Biology and Medicine*, ([Lai, 2021](#)) reviewed the research on the genetic effects of non-ionizing electromagnetic fields and found many studies reported effects in cells and animals after exposure to EMF at intensities similar to those in the public and occupational environments. Approximately 70% of reviewed studies showed effects including DNA strand breaks,

micronucleus formation, and chromosomal structural changes. Lai highlights how the effects are waveform and cell-type specific.

Dr. Lai's findings underscore the complexity of interactions between EMF and biological tissues, and may partially explain why effects were observed in some studies but not others. Lai states it is essential to understand why and how certain wave-characteristics of an EMF are more effective than other characteristics in causing biological effects, and why certain types of cells are more susceptible to EMF effects. Very significantly, Dr. Lai asserts that "there are different biological effects elicited by different EMF wave-characteristics" and this is a critical proof for the existence of non-thermal effects.

The review explains how genetic effects depend on various factors, including field parameters and characteristics (frequency, intensity, wave-shape), cell type, and exposure duration. Lai also found non-ionizing EMFs interact synergistically with different entities on genetic functions. These interactions, particularly with chemotherapeutic compounds, raise the possibility of using EMF as an adjuvant for cancer treatment to increase the efficacy and decrease side effects of traditional chemotherapeutic drugs.

Lai explains that since the energy level is not sufficient to cause direct breakage of chemical bonds within molecules, the effects are probably indirect and secondary to other induced chemical changes in the cell. He suspects that biological effects are caused by multiple inter-dependent biological mechanisms. He states that the mechanism remains to be uncovered, "but, knowing the mechanism is not necessary to accept that the data are valid. It is also a general criticism that most EMF studies cannot be replicated. I think it is a conceptual and factual misstatement. Replication is also not a necessary and sufficient condition to believe that certain data are true." Lai then states that, "to prove an effect, one should look for consistency in data. Genetic damage studies have shown similar effects with different set-up and in various biological systems. And, the gene expression results (Supplement 3) also support the studies on genetic damages. Expression of genes related to cell differentiation and growth, apoptosis, free radical activity, DNA repair, and heat-shock proteins have been reported. These changes could be consequences of EMF-induced genetic damages."

An October 2021 review "Human-made electromagnetic fields: Ion forced-oscillation and voltage-gated ion channel dysfunction, oxidative stress and DNA damage (Review)" in the *International Journal of Oncology* describes the cascade of effects from non-ionizing EMFs that lead to DNA damage. ([Panagopoulos et al., 2021](#)) documents the scientific research base indicating EMF exposures lead to ion channel dysfunction. According to the ion forced-oscillation mechanism for dysfunction of VGICs, human-made (polarized and coherent) ELF/ULF EMFs or the ELF/ULF modulation/pulsing/variability components of modern RF/WC EMFs can alter intracellular ionic concentrations by irregular gating of VGICs on cell membranes. This leads to immediate oxidative stress by ROS [oxidative stress that cause damage to lipids, proteins and DNA] (over)production in the cytosol and/or the mitochondria, which can damage DNA when cells are unable to reinstate electrochemical balance (normal

intracellular ionic concentrations). Consequently, DNA damage can lead to reproductive disabilities, neurodegenerative diseases, aging, genetic alterations and cancer.

Moreover, the review addresses how, in addition to polarization and coherence, ELF's are a common feature of almost all human-made EMF's. The authors suggest that the non-thermal biological effects attributed to RF EMF's are actually due to their ELF components. The researchers conclude that, "The long-existing experimental and epidemiological findings connecting exposure to human-made EMF's and DNA damage, infertility and cancer, are now explained by the presented complete mechanism. The present study should provide a basis for further research and encourage health authorities to take measures for the protection of life on Earth against unrestricted use of human-made EMF's."

NEW GOVERNMENT REPORTS AND RECOMMENDATIONS

The European Union

In July 2021, the European Parliament Panel for the Future of Science and Technology European Parliamentary Research Service Report "[Health Impact of 5G](#)" offered a review of the epidemiological and experimental evidence which has significantly increased since 2011 when the International Agency for Research on Cancer (IARC) classified radiofrequency (RF) EMF as "possibly carcinogenic to humans" (Group 2B). Due to the post-2011 published research, the IARC advisory group has now recommended RF exposure for re-evaluation "with high priority" (IARC, 2019). The report concludes that the body of evidence now indicates that the frequencies of 450 to 6,000 MHz are "probably carcinogenic for humans, in particular related to gliomas and acoustic neuromas."

For non-cancer effects the EU Report concludes that there was sufficient evidence of reproductive/developmental adverse effects in experimental animals and "these frequencies clearly affect male fertility and possibly female fertility too. They may have possible adverse effects on the development of embryos, fetuses and newborns." In regards to 5G's higher frequencies (24.25-27.5 GHz), and frequencies 24 to 100 GHz the systematic review found there was an inadequate base of studies either in humans or in experimental animals with which to even substantiate a conclusion one way or the other regarding a carcinogenic effect or any other non-thermal effect.

The report makes several policy recommendations, including:

- Adopting stricter RFR limits for mobile phone devices and reducing RFR exposure with devices that emit lower energy and "if possible only working when at a certain distance from the body".
- Revisiting RFR exposure limits for the public and the environment in order to reduce RF-EMF exposure from cell towers through more stringent limits such as those used in Italy, Switzerland, China, and Russia - all of which are significantly lower than those recommended by ICNIRP and the FCC.

- Adopting measures to incentivise the reduction of RF-EMF exposure which include using optic-fibre cables to connect schools, libraries, workplaces, houses, public buildings, and all new buildings etc. “Public gathering places could be 'no RF-EMF' areas (along the lines of no-smoking areas) so as to avoid the passive exposure of people not using a mobile phone or long-range transmission technology, thus protecting many vulnerable elderly or immune-compromised people, children, and those who are electro-sensitive.”
- Promoting a multidisciplinary scientific research effort to assess the long-term health effects of 5G millimeter waves (MMW) in order to rule out the risk that tumours and adverse effects on reproduction and development may occur upon exposure to 5G MMW, and to exclude the possibility of synergistic interactions between 5G MMW networks and other frequencies and networks that are already being used. Research is needed on the biological effects of 5G MMW at frequencies between 6 and 300 GHz not only for humans but also for the flora and fauna of the environment, e.g. non-human vertebrates, plants, fungi, and invertebrates.
- Promoting research to identify an adequate method of monitoring exposure to 5G because there is currently inadequate monitoring of the actual exposure of the population.
- Promoting a public educational awareness campaign on the potential harms of RFR at all levels, beginning with schools. This campaign should include the potential health risks, opportunities for digital development, safer infrastructure alternatives, and strategies to reduce exposure to wireless phones.

The report concludes that the gaps in knowledge in regards to 5G’s higher frequencies justify the call for a moratorium on 5G millimeter wave networks, pending completion of adequate research, “before exposing the whole world population and environment.” The report’s conclusion carries a very clear warning: “Implementing MMW 5G technology without further preventive studies would mean conducting an 'experiment' on the human population in complete uncertainty as to the consequences.”

In 2020, the European Parliament briefing [Effects of 5G wireless communication on human health](#) reviewed the various policies and reports in Europe including: 1) the 2011 Council of Europe Parliamentary Assembly [Resolution 1815](#) that recommended reducing RFR exposure; the fact that the European Environment Agency (EEA) has long advocated precaution concerning EMF exposure; 2) the European Commission Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) 2015 opinion and the organizations that suggest many members of SCENIHR could have conflict of interests, as they had professional relationships with or received funding from various telecom companies; 3) the Scientific Committee on Health, Environmental and Emerging Risks (SCHEER), replacing the former Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) evaluated the scale, urgency and interactions (with ecosystems and species) of possible hazard from 5G as *high as* “there could be biological consequences from a 5G environment.”

The briefing also highlighted the biological impacts from pulsations and modulations stating, “Studies show that pulsed EMF are in most cases more biologically active and therefore more dangerous than non-pulsed EMF. Every single wireless communication device

communicates at least partially via pulsations, and the smarter the device, the more pulsations. Consequently, even though 5G can be weak in terms of power, its constant abnormal pulse radiation can have an effect. Along with the mode and duration of exposures, characteristics of the 5G signal such as pulsing seem to increase the biologic and health impacts of exposure, including DNA damage, which is considered to be a cause of cancer. DNA damage is also linked to reproductive decline and neurodegenerative diseases.”

A review of occupational EMF exposures ([Stam, 2021](#)) of the National Institute for Public Health and the Environment of the Netherlands pointed to the need for exposure guidelines and regulation to incorporate new technology developments, especially in regards to 5G applications. Although ICNIRP’s thermally-based RFR limits were used as the action level in this article (and adverse biological effects have been found at non-thermal levels as documented in this report), this paper highlights the critical need to characterize occupational exposures and better assess health effects because of the new wireless networks found in the modern workplace.

In April 2020, the [Swiss Parliament refused](#) to weaken their RFR radiation limits. In September 2020, the Netherlands issued a [5G and Health Advisory Report](#) that recommended measuring environmental levels of RFR (an action the FCC does not take) and importantly, the Report also recommended *against* using the 26 GHz frequency band for 5G “for as long as the potential health risks have not been investigated.”

Starting in July 2020, new French government policy ensures that wireless companies label tablets, laptops, Wi-Fi routers, DECT phones and other wireless connected electronics with RFR SAR exposure levels at point of sale and in all advertising. Legislation in the country has long ensured labeling cell phones for SAR levels, but this did not apply to other wireless devices. Now all wireless devices used close to the head and body are potentially covered. The ANFR (The National Frequency Agency) [SAR Regulation Guide](#) lists the equipment qualified as radio equipment that required SAR testing. One category includes mobile phones, tablets equipped with a 3G or 4G/5G SIM card, connected watches that contain a mobile phone SIM card, 3G or 4G/5G pocket format routers, Maritime Portable VHF, laptops (3G or 4G/5G); and the second category includes DECT cordless phones, walkie-talkies or equivalent devices (PMR), tablets operating using Wi-Fi or bluetooth, wireless microphones, radio controls used for drones or model making, connected motorcycle helmets and Wi-Fi laptops. ANFR states that technological evolutions in connected objects may lead to the extension of this labeling to include radio frequency belts, connected glasses (“smart glasses”), wireless headphones or headsets, portable safety sensors (distance sensors) and virtual reality headsets.

Expert Recommendations to Minimize Exposure to Children

Since the COVID pandemic, there have been several new expert recommendations to reduce RFR exposure for children in virtual education on computers for 7 hours or more a day. For example, in April 2020 the [Cyprus National Committee on Environment and Children’s Health](#) released recommendations for parents on how to set up wired internet. In March 2020,

the [Scientific Research Institute of Hygiene and Children's Health of the Russian Ministry of Health and the Russian National Committee on Non-Ionizing Radiation Protection](#) also released recommendations for distance learning including restricting cell phones, using wired connections rather than Wi-Fi, reading real books and writing in real notebooks to support learning objectives. In November 2020, the Switzerland Doctors for Environmental Protection (AefU) released "[Consistently apply the precautionary principle in mobile communications](#)" demanding a reduction in exposure for children and youth.

Expert Appeals

Expert recommendations to reduce public and environmental exposures have escalated over the last two years. The [2020 Consensus Statement of UK and International Medical and Scientific Experts and Practitioners on Health Effects of Non-Ionising Radiation \(NIR\)](#) was signed by over 3500 medical doctors cautioning: "Hundreds of peer-reviewed scientific studies have demonstrated adverse biological effects occurring in response to a range of NIR [non-ionizing radiation] exposures below current safety guidelines; however emissions continue to escalate. Medical evidence of harm has now reached the critical mass necessary to inspire the medical community to step out of their usual roles, stand up and speak out regarding their concern."

Expert groups have continued to organize and call for urgent action in various countries. For example, in October 2020 a [letter](#) signed by 135 health professionals in Chile requested a moratorium on the deployment of 5G technology, and a [5G Appeal](#) was launched in support of a [new 5G petition](#): "Apoya con tu firma la carta de solicitud de moratoria al 5G en Chile enviada al Ministro Paris"; English Translation: "With your signature, support the letter requesting a moratorium on 5G in Chile sent to Minister Paris".

In France, a [September 2020 petition](#) addressed to the Prime Minister was signed by over 60 elected officials urging the government to assess environmental effects before deploying 5G. In Canada, the [Urgent Appeal to the Government of Canada to Suspend the 5G Rollout and to Choose Safe and Reliable Fiber Connections](#) was launched by Canadians for Safe Technology (C4ST) in May 2020. The Appeal calls for a systematic review of the scientific evidence of health effects of RFR as well as binding guidelines to protect wildlife and the environment from RFR. The CEO of C4ST calling for this review is Frank Clegg, the former Chairman of Microsoft Canada.

Medical Conference on EMF

In 2021, the EMF Medical Conference 2021 presented evidence based information on the prevention, diagnosis and treatment of EMF associated illness featuring leading EMF experts in science, medicine, health and assessment. These proceedings are available as online courses for continuing medical education credits for medical doctors and health professionals. See www.emfconference2021.com

Expert Recommendations in the USA

The New Hampshire State Commission released its [2020 Report on 5G Health and Environment](#) with 15 recommendations that included reducing public exposure to RFR via wired (not Wi-Fi) internet connections in schools and libraries; software changes to phones and wireless devices to minimize exposure; informing the public about RFR exposures via educational campaigns and public posting of RFR levels; government measuring of RFR exposures; developing updated safety standards to protect the public and environment; and ensuring independent scientific review of the research.

On June 17th, 2020, over U.S. 400 medical professionals wrote the FCC [a letter](#) calling for consideration of non-thermal biological impacts. The Alliance of Nurses for Healthy Environments (ANHE), a national organization of nurses, also sent [a 2020 letter](#) calling for the FCC to address the science on children's vulnerability.

Over the last two years, several U.S. cities have passed resolutions and policies to halt increased RFR exposure and to ensure adequate scientific review of the health effects of RFR radiation. For example, [Hawai'i County \(July 2020\)](#), [Easton Connecticut \(May 2020\)](#), [Keene New Hampshire \(March 2020\)](#) and [Farragut Tennessee \(May 2020\)](#) have passed resolutions to halt 5G. The Coconut Creek Florida Commission adopted a [Resolution on 5G and radiofrequency radiation](#) (November 2020) "imploring the US Congress to allocate funding and direct a cross discipline federal agency study of the effects caused by exposure to current and proposed electromagnetic spectrum and radiofrequency commissions on human health and the environment in light of the recent implementation of fifth generation technology and to use those findings to create science based laws or rules regarding limiting human and environmental exposure."

On April 2, 2021 Montgomery County Maryland Council President Hucker and County Executive Elrich sent [a letter to U.S. Senator Chris Van Hollen](#) that included two specific requests regarding RFR:

"Request responsibility for setting RF standards be transferred from the Federal Communications Commission (FCC) - a regulatory agency - to the National Institute of Standards and Technology (NIST) - a standards setting body. Direct NIST to complete a review of credible published papers on the health effects of RF emissions on humans, including women and children, and tests to measure biological impact on humans, and thermal and biological tests of RF at different frequencies within 6 months. Further direct NIST to create and update thermal and biological standards for smartphones, small cells, and household Internet-of-Things (IoT) devices, Wi-Fi, and Bluetooth devices within 2 years and review and update standards every 5 years thereafter.

Environmental Groups

Internationally and in the USA, environmental groups have issued statements and positions calling for protections for the environment before allowing wireless network proliferation. For example, in 2021, a major environmental group in Spain, Ecologistas en Accion or [Ecologists in Action](#) issued a [position on 5G](#) calling for precaution. They propose information campaigns, reducing exposure, monitoring compliance and requiring transparency, impartiality and plurality in health risk assessments. They also recommend wireless networks are replaced with wired connections and the recognition of electrohypersensitivity syndrome as an environmental disease with protections that include the creation of EMF-free zones.

In February 2021, the Green Party of California issued a [Statement on 5G Wireless Technology](#) advocating for “robust and independent scientific environmental review of 4G/5G wireless exposure” and to reduce exposures per the As Low As Reasonably Achievable (ALARA) principle. It is notable that environmental organizations are also issuing statements regarding the increased energy consumption of 5G. For example, Greenpeace France’s [“What is Digital Pollution”](#) addresses how 5G will increase “digital pollution.” Several investigative articles have been published on the environmental impacts including [“How Green is 5G?”](#) published November 2021 in Envirotech Magazine; [“What Will 5G Mean for the Environment?”](#) published January 2020 by Clair Curran of the Henry M. Jackson School of International Studies; and [“Is Wireless Technology an Environmental Health Risk?”](#) published January 2021 by Katie Alvord in the journal of the Society of Environmental Journalists.

5G NETWORKS AND MILLIMETER WAVE FREQUENCIES

The review paper “Adverse health effects of 5G mobile networking technology under real-life conditions” ([Kostoff et al., 2020](#)) published in *Toxicology Letters* identified a wide range of adverse systemic effects from 5G network deployment when real life conditions are considered such as the information content of signals along with the carrier frequencies and other toxic stimuli that can act in combination with the exposure. Many experiments do not include the real-life pulsing and modulation of the carrier signal. The vast majority of experiments do not account for synergistic adverse effects of other toxic stimuli with wireless radiation. 5G mobile networking technology will affect the skin and eyes and has adverse systemic effects. “In aggregate, for the high frequency (radiofrequency-RF) part of the spectrum, these reviews show that RF radiation below the FCC guidelines can result in: carcinogenicity (brain tumors/glioma, breast cancer, acoustic neuromas, leukemia, parotid gland tumors), genotoxicity (DNA damage, DNA repair inhibition, chromatin structure), mutagenicity, teratogenicity, neurodegenerative diseases (Alzheimer’s Disease, Amyotrophic Lateral Sclerosis), neurobehavioral problems, autism, reproductive problems, pregnancy outcomes, excessive reactive oxygen species/oxidative stress, inflammation, apoptosis, blood-brain barrier disruption, pineal gland/melatonin production, sleep disturbance, headache, irritability, fatigue, concentration difficulties, depression, dizziness, tinnitus, burning and flushed skin, digestive disturbance, tremor, cardiac irregularities, adverse impacts on the neural, circulatory, immune, endocrine, and skeletal systems.” The authors conclude that “Superimposing 5G radiation on an already imbedded toxic wireless radiation environment will exacerbate the adverse health

effects shown to exist. Far more research and testing of potential 5G health effects under real-life conditions is required before further rollout can be justified.”

In “Absorption of 5G Radiation in Brain Tissue as a Function of Frequency, Power and Time” published in *IEEE Access* ([Gultekin & Siegal, 2020](#)) examines the beam penetration, absorption and thermal diffusion at representative 4G and 5G frequencies and shows that RF heating increases rapidly with frequency due to decreasing RF source wavelength and increasing power density with the same incident power and exposure time.

([Trillo et al., 2021](#)) in their paper “Effects of the signal modulation on the response of human fibroblasts to in vitro stimulation with subthermal RF currents” published in *Electromagnetic Biology and Medicine* found the modulated signal was more efficient in inducing Hsp27 and decorin overexpression and promoting cell proliferation. “These data indicate that the cellular response is dependent on the RF signal modulation...”

5G human exposure studies include ([Kim & Nasim, 2020](#)). In their paper “Human Electromagnetic Field Exposure in 5G at 28 GHz” published in *IEEE Consumer Electronics Magazine* the authors compared the human EMF exposure in a 5G system to previous-generations of cellular systems. They suggest a minimum separation distance between a transmitter and a human user in order to keep exposure compliant with regulatory limits.

In their paper “Human RF-EMF Exposure Assessment Due to Access Point in Incoming 5G Indoor Scenario” published in *IEEE Journal of Electromagnetics, RF and Microwaves in Medicine and Biology* ([Bonato et al., 2021](#)) simulated the exposure to an adult and child from an indoor 5G access points (3.7 GHz and at 14 GHz) to evaluate how beamforming and the higher frequency use could impact exposure levels and found the reciprocal position between the antenna and the model head and the frequency range and the distance are factors that could greatly influence the exposure levels.

“Physiological effects of millimeter-waves on skin and skin cells: an overview of the to-date published studies” published in *Reviews on Environmental Health* is an overview of the physiological effects of millimeter waves on skin and skin cells ([Leszczynski, 2020](#)) by Dr. Leszczynski, one of the IARC working group members who voted 29 to 1 in May 2011 to classify RF-EMF as a 2B or “possible human” carcinogen. The author explains how the skin and eyes are directly exposed to the millimeter-waves from 5G and yet the current body of research on millimeter-waves is insufficient to devise science-based exposure limits and policies. He recommends precautionary measures such as postponing or limiting 5G deployment in residential areas until adequate research studies scientifically establish safety thresholds.

In “Limiting liability with positioning to minimize negative health effects of cellular phone towers” published in *Environmental Research* ([Pearce, 2020](#)) summarizes the peer-reviewed literature on the effects of RFR from cellular phone base stations and concludes that, “to protect cell phone tower firms, companies should seek to minimize human RFR exposure” because there is “already enough medical-scientific evidence to warrant long-term liability concerns.”

In “Millimeter (MM) wave and microwave frequency radiation produce deeply penetrating effects: the biology and the physics” published in *Reviews on Environmental Health*, ([Pall, 2021](#))

highlights three very important findings “rarely recognized in the EMF scientific literature: coherence of electronically generated EMFs; the key role of time-varying magnetic fields in generating highly penetrating effects; the key role of both modulating and pure EMF pulses in greatly increasing very short term high level time-variation of magnetic and electric fields. It is probable that genuine safety guidelines must keep nanosecond timescale-variation of coherent electric and magnetic fields below some maximum level in order to produce genuine safety. These findings have important implications with regard to 5G radiation.”

STANDARDS

The Environmental Working Group modeled the health effects incidence data from the National Toxicology Program (NTP) cell phone radiation studies to estimate departure points for exposure guidelines in a landmark [analysis](#) published in *Environmental Health*. The NTP study reported an increased incidence of cardiomyopathy in female and male rats and increased incidences of various neoplasms in male rats. They concluded that FCC limits should be strengthened by 200 to 400 times to protect children according to current risk assessment guidelines concluding that “the analysis presented here supports a whole-body SAR limit of 2 to 4 mW/kg for adults, an exposure level that is 20- to 40-fold lower than the legally permissible limit of 0.08 W/kg for whole-body SAR under the current U.S. regulations. A ten-fold lower level of 0.2–0.4 mW/kg whole-body SAR may be appropriate for young children.

Both technology changes and behavior changes may be necessary to achieve these lower exposure levels. In “Development of health-based exposure limits for radiofrequency radiation from wireless devices using a benchmark dose approach” published in *Environmental Health*, the authors suggest: “Simple actions such as keeping the wireless devices farther away from the body offer an immediate way to decrease RFR exposure for the user.” ([Uche, 2021](#))

In April 2020, Barnes and Greenebaum published “[Setting Guidelines Electromagnetic Exposures Research Needs](#)”, in *Bio Electro Magnetism* about the fact that current limits for exposures to non-ionizing electromagnetic fields do not address long-term exposures but are instead based on relatively short-term exposures. “What is missing in the current guidelines or regulations are guidelines for long-term exposure to weak EMF.” The authors document the science substantiating their recommendations for next steps regarding research and approaches for more protective exposure guidelines. They conclude that the science is sufficient indicating biological impacts at low levels:

“However, over the last 20 years the evidence has become extremely strong that weaker EMF over the whole range for frequencies from static through millimeter waves can modify biological processes. There is now solid experimental evidence and supporting theory showing that weak fields, especially but not exclusively at low frequencies, can modify reactive free radical concentrations and that changes in radical concentration and that of other signaling molecules, such as hydrogen peroxide and calcium, can modify biological processes...”

The authors posit with copious scientific documentation how non-ionizing EMFs can impact cancer cell growth rates, membrane potentials, concentrations of calcium, reactive oxygen species (ROS), superoxide (O₂⁻), nitric oxide (NO), hydrogen peroxide (H₂O₂), and intercellular pH, specifically highlighting the issue of oxidative stress as long-term elevations “are associated with cancer, aging, and Alzheimer’s.” They highlight how funding for research into the effects of EMF in the United States “is close to nonexistent” and make numerous recommendations for research studies. They also recommend, for example, that guidelines be set at three levels: the individual user, local company, and national or international level and posit that recommended limits could well be a function of frequency, amplitude, and modulation systems as well as be dependent on the condition of the person being exposed. Barnes and Greenebaum acknowledge, “There seem to be a smaller number of ‘hypersensitive people’ who have very real and serious problems” from exposure to weak RF fields.

The co-authors conclude: “We believe a carefully targeted program of federal research funds is called for, supplemented by communications system operators and corporations that manufacture equipment, under independent scientific management. Both governmental and private entities that emit RF signals would be well advised to fund research to elucidate and define threshold signal levels for the generation of long-term biological effects.”

CANCER

The evidence that RFR is a human carcinogen has continued to increase with the publication of several new research studies and papers. Furthermore, cancer incidence is rising among children and young adults. The latest [U.S. Annual Report to the Nation on the Status of Cancer](#) (a collaborative effort among the American Cancer Society, the Centers for Disease Control and Prevention, the National Cancer Institute, part of the National Institutes of Health; and the North American Association of Central Cancer Registries) published in *Journal of the National Cancer Institute* found higher overall cancer incidence rates in children and young adults in almost all racial/ethnic groups, with increasing trends for the most common cancer types among children including leukemia, brain and other nervous system cancers, and lymphoma.

In November 2020 a systematic review and meta-analysis of case-control studies by [\(Choi et al., 2020\)](#), “Cellular Phone Use and Risk of Tumors: Systematic Review and Meta-Analysis”, was published in *Environmental Research and Public Health*. The authors found evidence that linked cellular phone use to increased tumor risk. The meta-analysis established that 1,000 or more hours of cell phone use, or about 17 minutes per day over 10 years, was associated with a statistically significant 60% increase in brain tumor risk.

In their paper “Genetic susceptibility may modify the association between cell phone use and thyroid cancer: A population-based case-control study in Connecticut” published in *Environmental Research* [\(Luo et al., 2020\)](#), the Yale researchers with support from the American Cancer Society found cell phone use was significantly associated with thyroid cancer in people with a type of common genetic variation. The association increased as cell phone use

duration and frequency increased. The authors conclude that their findings “provide more evidence for RFR carcinogenic group classification.”

Regarding the impact of EMFs to the thyroid, a 2021 review by California Institute of Behavioral Neurosciences & Psychology researchers ([Alkayyali et al., 2021](#)) focused on thyroid hormones and thyroid gland histopathology documented studies indicating that RFR could be associated with alterations in hormone levels and impacts such as the hyperstimulation of thyroid gland follicles, causing oxidative stress and apoptosis of follicular cells. In “An Exploration of the Effects of Radiofrequency Radiation Emitted by Mobile Phones and Extremely Low Frequency Radiation on Thyroid Hormones and Thyroid Gland Histopathology” published in *Cureus*, the researchers found studies correlated thyroid impacts to the exposure duration, intensity, and SAR value of the RFR exposure. The authors state that “non-ionizing EMF radiation might be responsible for the recent increase in the incidence of thyroid insufficiency and cancer in the general population.”

In “The Effect of Continuous Low-Intensity Exposure to Electromagnetic Fields from Radio Base Stations to Cancer Mortality in Brazil” ([Rodrigues et al. 2020](#)) published their findings in the *International Journal of Environmental Research and Public Health* linking higher exposure to radio frequency radiation from cell antenna installations in Brazil to increased deaths from cancers. For all cancers and for the specific types investigated (breast, cervix, lung, and esophagus cancers), the higher the exposure, the higher the median of mortality rate.

The last two years of research has significantly increased the scientific evidence that RFR can increase oxidative stress, a hallmark of cancer, addressed earlier in this document. However, in addition, there are other endpoints associated with cancer that have been published in the last two years increasing the evidence related to the carcinogenicity of RFR. For example, ([Ghandehari et al. 2021](#)) found increased cell phone usage significantly correlated with a higher frequency of the micronucleus containing buccal mucosa cells and a higher frequency of micronucleus in each cell in the buccal mucosa. In “Micronucleus Assay in Cell Phone Users: Importance of Oral Mucosa Screening” published in *International Journal of Preventive Medicine*, the authors surmise, “Based on these results, it can be concluded that human buccal cells are likely to show increased micronucleus cells as a result of the genotoxic effects of cell phone waves which have been chronically exposed.”

Micronuclei are biomarkers of disease and they play an active role in tumor biology ([Kwon et al. 2020](#)). ([Yao et al. 2021](#)), in “The biological effects of electromagnetic exposure on immune cells and potential mechanisms” published in *Electromagnetic Biology and Medicine*, undertake a review of the biological effects of electromagnetic exposure on immune cells. The researchers found: “Accumulated data suggested that electromagnetic exposure could affect the number and function of immune cells to some extent, including cell proportion, cell cycle, apoptosis, killing activity, cytokines contents...”; and the authors conclude that, “knowledge of the biological effects on immune cells associated with electromagnetic fields is critical for proper health hazard evaluation, development of safety standards, and safe exploitation of new electromagnetic devices and applications.”

([Hardell & Carlberg, 2021](#)) published “Lost opportunities for cancer prevention: historical evidence on early warnings with emphasis on radiofrequency radiation” in *Reviews in Environmental Health*. This eloquent review gives insight into missed opportunities for cancer prevention exemplified by asbestos, tobacco, certain pesticides and now RF radiation. The authors highlight how economic considerations were favored instead of cancer prevention. “A strategy to sow doubt on cancer risks was established decades ago and is now adopted and implemented in a more sophisticated way by the telecom industry regarding RF-EMF risks to human beings and the environment. Industry has the economic power, access to politicians and media whereas concerned people are unheard.” The examples clearly show that if the scientific evidence on cancer risks had been taken seriously, many lives could have been saved.

The 2020 study “[Increased Generational Risk of Colon and Rectal Cancer in Recent Birth Cohorts under Age 40 - the Hypothetical Role of Radiofrequency Radiation from Cell Phones](#)” published in *Annals of Gastroenterology and Digestive Disorders* by Davis et al. presented data from the U.S. Centers for Disease Control and Prevention, the U.S. Surveillance Epidemiology and End-Results Program and Iranian cancer registries on the staggering increases in colon and rectal cancer in those under age 50. Those born in the U.S. in the 1990s have a doubled risk of colon cancer and a fourfold increase in rectal cancer by the time they reach age 24 compared to those born six decades ago. The researchers document experimental studies indicating that cells from the colon and rectum of Sprague-Dawley rats are exquisitely sensitive to RFR and assert that these cancer increases could be due to the way people carry cell phones close to their bodies in front and back pockets. They reference how the French government frequency testing agency (ANFR) found that 9 out of 10 phones exceeded the safety guidelines when held against the body by factors of 1.6-3.7 times for the European standard or by factors as high as 11 if 1-g SAR values were to be measured as required by the U.S. FCC. “It appears prudent to promote policies to reduce exposures to radiofrequency radiation and encourage ALARA during pediatric CT procedures, while continuing to promote advances in software and hardware of phones and scanners that can lower exposures to non-ionizing radiation during normal operations. In addition, major public educational programs should be developed to promote awareness of the need to practice safer technology, especially for the young, who may well be at greater risk of developing cancer due to their immunological immaturity.”

In March 2021, Christopher Portier, Ph.D., formerly the Director of the United States National Center for Environmental Health at the Centers for Disease Control and Prevention (CDC) in Atlanta and the Director of the Agency for Toxic Substances and Disease Registry submitted a [comprehensive review](#) of the scientific research in a major cell phone/brain cancer lawsuit where he concludes: “The evidence on an association between cellular phone use and the risk of glioma in adults is quite strong.” Portier further states in his Expert Report: “In my opinion, RF exposure probably causes gliomas and neuromas and, given the human, animal and experimental evidence, I assert that, to a reasonable degree of scientific certainty, the probability that RF exposure causes gliomas and neuromas is high.”

A important paper was published in *Health Physics* in 2020 by longtime NIH scientist Dr. Ronald Melnick entitled [“ICNIRP’S Evaluation of the National Toxicology Program’s Carcinogenicity Studies on Radiofrequency Electromagnetic Fields”](#) addressing numerous criticisms of the NTP findings. Melnick documents one by one how these criticisms include false claims and “several incorrect statements that appear to be written to justify retaining exposure standards that were established more than 20 years ago.” He presents the scientific documentation that each of these criticisms are unfounded stating “ICNIRP’s misrepresentation of the methodology and interpretation of the NTP studies on cell phone RF radiation does not support their conclusion that “limitations preclude drawing conclusions about carcinogenicity in relation to RF EMFs.”

Melnick explains that the utility of the NTP studies for assessing human health risks is undermined by the incorrect statements and misinformation in the ICNIRP critique. Melnick describes how the ICNIRP note failed to recognize that focal hyperplasias (proliferative lesions) of glial cells in the brain and of Schwann cells in the heart are putative preneoplastic lesions that may progress to malignant glioma or to cardiac schwannoma tumors, respectively.

Further, Melnick documents how the ICNIRP note focused on the carcinogenicity but ignored other adverse biological effects observed in the NTP studies, including reduced birth weights, DNA strand breaks in brain cells (which is supportive of the cancer findings), increased incidences of proliferative lesions (tumors and hyperplasia) in the prostate gland, and exposure-related increases in the incidence of cardiomyopathy (a type of tissue damage) of the right ventricle of the heart in male and female rats.

“After all, it was the US Food and Drug Administration that requested the NTP studies of cell phone radiation in experimental animals to provide the basis to assess the risk to human health. The NTP studies show that the assumption that RF radiation is incapable of causing cancer or other adverse health effects other than by tissue heating is wrong. If ICNIRP’s goal is truly aimed at protecting the public from potential harm, then it would be appropriate for this group to quantify the health risks associated with exposure to RF-EMFs and then develop health-protective guidelines for chronic exposures, especially for children, who are likely to be more susceptible than adults to adverse effects of RF radiation.”

These studies are a small sampling of the numerous studies that have documented adverse effects from RFR.

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Planetary electromagnetic pollution: it is time to assess its impact



As the Planetary Health Alliance moves forward after a productive second annual meeting, a discussion on the rapid global proliferation of artificial electromagnetic fields would now be apt. The most notable is the blanket of radiofrequency electromagnetic radiation, largely microwave radiation generated for wireless communication and surveillance technologies, as mounting scientific evidence suggests that prolonged exposure to radiofrequency electromagnetic radiation has serious biological and health effects. However, public exposure regulations in most countries continue to be based on the guidelines of the International Commission on Non-Ionizing Radiation Protection¹ and Institute of Electrical and Electronics Engineers,² which were established in the 1990s on the belief that only acute thermal effects are hazardous. Prevention of tissue heating by radiofrequency electromagnetic radiation is now proven to be ineffective in preventing biochemical and physiological interference. For example, acute non-thermal exposure has been shown to alter human brain metabolism by NIH scientists,³ electrical activity in the brain,⁴ and systemic immune responses.⁵ Chronic exposure has been associated with increased oxidative stress and DNA damage^{6,7} and cancer risk.⁸ Laboratory studies, including large rodent studies by the US National Toxicology Program⁹ and Ramazzini Institute of Italy,¹⁰ confirm these biological and health effects in vivo. As we address the threats to human health from the changing environmental conditions due to human activity,¹¹ the increasing exposure to artificial electromagnetic radiation needs to be included in this discussion.

Due to the exponential increase in the use of wireless personal communication devices (eg, mobile or cordless phones and WiFi or Bluetooth-enabled devices) and the infrastructure facilitating them, levels of exposure to radiofrequency electromagnetic radiation around the 1 GHz frequency band, which is mostly used for modern wireless communications, have increased from extremely low natural levels by about 10^{18} times (figure). Radiofrequency electromagnetic radiation is also used for radar, security scanners, smart meters, and medical equipment (MRI, diathermy, and radiofrequency ablation). It is plausibly the most rapidly increasing

anthropogenic environmental exposure since the mid-20th century, and levels will surge considerably again, as technologies like the Internet of Things and 5G add millions more radiofrequency transmitters around us.

Unprecedented human exposure to radiofrequency electromagnetic radiation from conception until death has been occurring in the past two decades. Evidence of its effects on the CNS, including altered neurodevelopment¹⁴ and increased risk of some neurodegenerative diseases,¹⁵ is a major concern considering the steady increase in their incidence. Evidence exists for an association between neurodevelopmental or

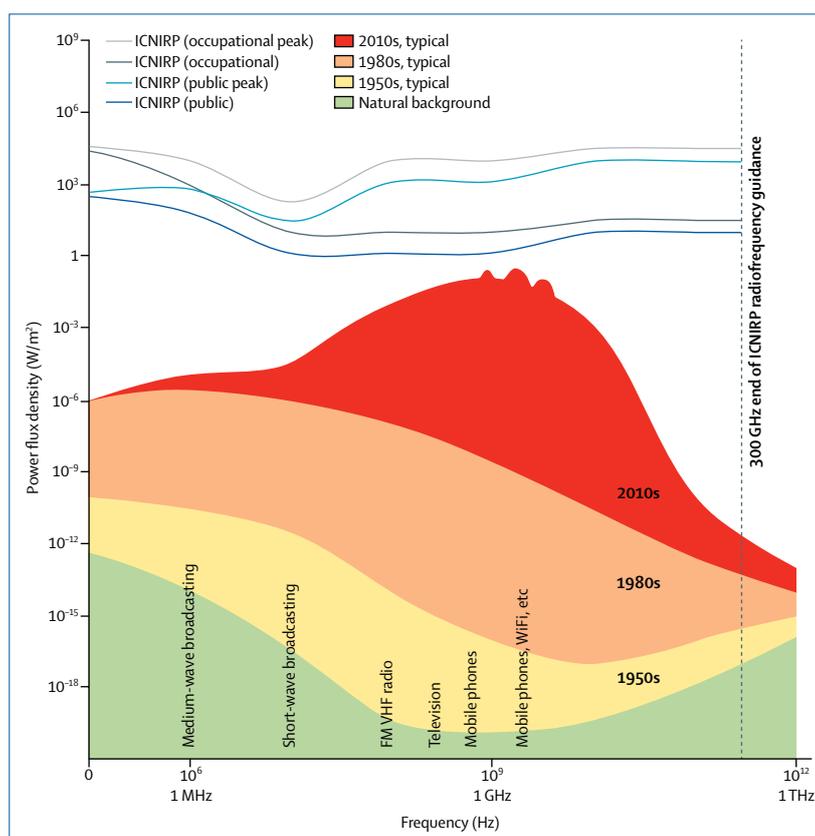


Figure: Typical maximum daily exposure to radiofrequency electromagnetic radiation from man-made and natural power flux densities in comparison with International Commission on Non-Ionizing Radiation Protection safety guidelines¹

Anthropogenic radiofrequency electromagnetic radiation levels are illustrated for different periods in the evolution of wireless communication technologies. These exposure levels are frequently experienced daily by people using various wireless devices. The levels are instantaneous and not time-averaged over 6 minutes as specified by International Commission on Non-Ionizing Radiation Protection for thermal reasons. Figure modified from Philips and Lamburn¹² with permission. Natural levels of radiofrequency electromagnetic radiation were based on the NASA review report CR-166661.¹³

For the Oceania Radiofrequency Scientific Advisory Association see www.orsaa.org

behavioural disorders in children and exposure to wireless devices,¹⁴ and experimental evidence, such as the Yale finding, shows that prenatal exposure could cause structural and functional changes in the brain associated with ADHD-like behaviour.¹⁶ These findings deserve urgent attention.

At the Oceania Radiofrequency Scientific Advisory Association, an independent scientific organisation, volunteering scientists have constructed the world's largest categorised online database of peer-reviewed studies on radiofrequency electromagnetic radiation and other man-made electromagnetic fields of lower frequencies. A recent evaluation of 2266 studies (including in-vitro and in-vivo studies in human, animal, and plant experimental systems and population studies) found that most studies (n=1546, 68.2%) have demonstrated significant biological or health effects associated with exposure to anthropogenic electromagnetic fields. We have published our preliminary data on radiofrequency electromagnetic radiation, which shows that 89% (216 of 242) of experimental studies that investigated oxidative stress endpoints showed significant effects.⁷ This weight of scientific evidence refutes the prominent claim that the deployment of wireless technologies poses no health risks at the currently permitted non-thermal radiofrequency exposure levels. Instead, the evidence supports the International EMF Scientist Appeal by 244 scientists from 41 countries who have published on the subject in peer-reviewed literature and collectively petitioned the WHO and the UN for immediate measures to reduce public exposure to artificial electromagnetic fields and radiation.

Evidence also exists of the effects of radiofrequency electromagnetic radiation on flora and fauna. For example, the reported global reduction in bees and other insects is plausibly linked to the increased radiofrequency electromagnetic radiation in the environment.¹⁷ Honeybees are among the species that use magnetoreception, which is sensitive to anthropogenic electromagnetic fields, for navigation.

Man-made electromagnetic fields range from extremely low frequency (associated with electricity supplies and electrical appliances) to low, medium, high, and extremely high frequency (mostly associated with wireless communication). The potential effects of these anthropogenic electromagnetic fields on

natural electromagnetic fields, such as the Schumann Resonance that controls the weather and climate, have not been properly studied. Similarly, we do not adequately understand the effects of anthropogenic radiofrequency electromagnetic radiation on other natural and man-made atmospheric components or the ionosphere. It has been widely claimed that radiofrequency electromagnetic radiation, being non-ionising radiation, does not possess enough photon energy to cause DNA damage. This has now been proven wrong experimentally.^{18,19} Radiofrequency electromagnetic radiation causes DNA damage apparently through oxidative stress,⁷ similar to near-UV radiation, which was also long thought to be harmless.

At a time when environmental health scientists tackle serious global issues such as climate change and chemical toxicants in public health, there is an urgent need to address so-called electrosmog. A genuine evidence-based approach to the risk assessment and regulation of anthropogenic electromagnetic fields will help the health of us all, as well as that of our planetary home. Some government health authorities have recently taken steps to reduce public exposure to radiofrequency electromagnetic radiation by regulating use of wireless devices by children and recommending preferential use of wired communication devices in general, but this ought to be a coordinated international effort.

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Risks to Health and Well-Being From Radio-Frequency Radiation Emitted by Cell Phones and Other Wireless Devices

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Radiation exposure has long been a concern for the public, policy makers, and health researchers. Beginning with radar during World War II, human exposure to radio-frequency radiation¹ (RFR) technologies has grown substantially over time. In 2011, the *International Agency for Research on Cancer* (IARC) reviewed the published literature and categorized RFR as a “possible” (Group 2B) human carcinogen. A broad range of adverse human health effects associated with RFR have been reported since the IARC review. In addition, three large-scale carcinogenicity studies in rodents exposed to levels of RFR that mimic lifetime human exposures have shown significantly increased rates of Schwannomas and malignant gliomas, as well as chromosomal DNA damage. Of particular concern are the effects of RFR exposure on the developing brain in children. Compared with an adult male, a cell phone held against the head of a child exposes deeper brain structures to greater radiation doses per unit volume, and the young, thin skull’s bone marrow absorbs a roughly 10-fold higher local dose. Experimental and observational studies also suggest that men who keep cell phones in their trouser pockets have significantly lower sperm counts and significantly impaired sperm motility and morphology, including mitochondrial DNA damage. Based on the accumulated evidence, we recommend that IARC re-evaluate its 2011 classification of the human carcinogenicity of RFR, and that WHO complete a systematic review of multiple other health effects such as sperm damage. In the interim, current knowledge provides justification for governments, public health authorities, and physicians/allied health professionals to warn the population that having a cell phone next to the body is harmful, and to support measures to reduce all exposures to RFR.

Keywords: brain cancer, electromagnetic hypersensitivity, glioma, non-cancer outcomes, policy recommendations, radiofrequency fields, child development, acoustic neuroma

¹Per IEEE C95.1-1991, the radio-frequency radiation frequency range is from 3 kHz to 300 GHz and is non-ionizing.

INTRODUCTION

We live in a generation that relies heavily on technology. Whether for personal use or work, wireless devices, such as cell phones, are commonly used around the world, and exposure to radio-frequency radiation (RFR) is widespread, including in public spaces (1, 2).

In this review, we address the current scientific evidence on health risks from exposure to RFR, which is in the non-ionizing frequency range. We focus here on human health effects, but also note evidence that RFR can cause physiological and/or morphological effects on bees, plants and trees (3–5).

We recognize a diversity of opinions on the potential adverse effects of RFR exposure from cell or mobile phones and other wireless transmitting devices (WTDs) including cordless phones and Wi-Fi. The paradigmatic approach in cancer epidemiology, which considers the body of epidemiological, toxicological, and mechanistic/cellular evidence when assessing causality, is applied.

CARCINOGENICITY

Since 1998, the *International Commission on Non-Ionizing Radiation Protection* (ICNIRP) has maintained that no evidence of adverse biological effects of RFR exist, other than tissue heating at exposures above prescribed thresholds (6).

In contrast, in 2011, an expert working group of the *International Agency for Research on Cancer* (IARC) categorized RFR emitted by cell phones and other WTDs as a Group 2B (“possible”) human carcinogen (7).

Since the IARC categorization, analyses of the large international Interphone study, a series of studies by the Hardell group in Sweden, and the French CERENAT case-control studies, signal increased risks of brain tumors, particularly with ipsilateral use (8). The largest case-control studies on cell phone exposure and glioma and acoustic neuroma demonstrated significantly elevated risks that tended to increase with increasing latency, increasing cumulative duration of use, ipsilateral phone use, and earlier age at first exposure (8).

Pooled analyses by the Hardell group that examined risk of glioma and acoustic neuroma stratified by age at first exposure to cell phones found the highest odds ratios among those first exposed before age 20 years (9–11). For glioma, first use of cell phones before age 20 years resulted in an odds ratio (OR) of 1.8 (95% confidence interval [CI] 1.2–2.8). For ipsilateral use, the OR was 2.3 (CI 1.3–4.2); contralateral use was 1.9 (CI 0.9–3.7). Use of cordless phone before age 20 yielded OR 2.3 (CI 1.4–3.9), ipsilateral OR 3.1 (CI 1.6–6.3) and contralateral use OR 1.5 (CI 0.6–3.8) (9).

Although Karipidis et al. (12) and Nilsson et al. (13) found no evidence of an increased incidence of gliomas in recent years in Australia and Sweden, respectively, Karipidis et al. (12) only reported on brain tumor data for ages 20–59 and Nilsson et al. (13) failed to include data for high grade glioma. In contrast, others have reported evidence that increases in specific types of brain tumors seen in laboratory studies are occurring in Britain and the US:

- The incidence of neuro-epithelial brain cancers has significantly increased in all children, adolescent, and young adult age groupings from birth to 24 years in the United States (14, 15).
- A sustained and statistically significant rise in glioblastoma multiforme across all ages has been described in the UK (16).

The incidence of several brain tumors are increasing at statistically significant rates, according to the 2010–2017 *Central Brain Tumor Registry of the U.S.* (CBTRUS) dataset (17).

- There was a significant increase in incidence of radiographically diagnosed tumors of the pituitary from 2006 to 2012 (APC = 7.3% [95% CI: 4.1%, 10.5%]), with no significant change in incidence from 2012 to 2015 (18).
- Meningioma rates have increased in all age groups from 15 through 85+ years.
- Nerve sheath tumor (Schwannoma) rates have increased in all age groups from age 20 through 84 years.
- Vestibular Schwannoma rates, as a percentage of nerve sheath tumors, have also increased from 58% in 2004 to 95% in 2010–2014.

Epidemiological evidence was subsequently reviewed and incorporated in a meta-analysis by Rööslä et al. (19). They concluded that overall, epidemiological evidence does not suggest increased brain or salivary gland tumor risk with mobile phone (MP) use, although the authors admitted that some uncertainty remains regarding long latency periods (>15 years), rare brain tumor subtypes, and MP usage during childhood. Of concern is that these analyses included cohort studies with poor exposure classification (20).

In epidemiological studies, recall bias can play a substantial role in the attenuation of odds ratios toward the null hypothesis. An analysis of data from one large multicenter case-control study of RFR exposure, did not find that recall bias was an issue (21). In another multi-country study it was found that young people can recall phone use moderately well, with recall depending on the amount of phone use and participants’ characteristics (22). With less rigorous querying of exposure, prospective cohort studies are unfortunately vulnerable to exposure misclassification and imprecision in identifying risk from rare events, to the point that negative results from such studies are misleading (8, 23).

Another example of disparate results from studies of different design focuses on prognosis for patients with gliomas, depending upon cell phone use. A Swedish study on glioma found lower survival in patients with glioblastoma associated with long term use of wireless phones (24). Ollson et al. (25), however, reported no indication of reduced survival among glioblastoma patients in Denmark, Finland and Sweden with a history of mobile phone use (ever regular use, time since start of regular use, cumulative call time overall or in the last 12 months) relative to no or non-regular use. Notably, Olsson et al. (25) differed from Carlberg and Hardell (24) in that the study did not include use of cordless phones, used shorter latency time and excluded patients older than 69 years. Furthermore, a major shortcoming was that patients with the worst prognosis were excluded, as in Finland

inoperable cases were excluded, all of which would bias the risk estimate toward unity.

In the interim, three large-scale toxicological (animal carcinogenicity) studies support the human evidence, as do modeling, cellular and DNA studies identifying vulnerable subgroups of the population.

The *U.S. National Toxicology Program (NTP)* (National Toxicology Program (26, 27) has reported significantly increased incidence of glioma and malignant Schwannoma (mostly on the nerves on the heart, but also additional organs) in large animal carcinogenicity studies with exposure to levels of RFR that did not significantly heat tissue. Multiple organs (e.g., brain, heart) also had evidence of DNA damage. Although these findings have been dismissed by the ICNIRP (28), one of the key originators of the NTP study has refuted the criticisms (29).

A study by Italy's Ramazzini Institute has evaluated lifespan environmental exposure of rodents to RFR, as generated by 1.8 GHz GSM antennae of cell phone radio base stations. Although the exposures were 60 to 6,000 times lower than those in the NTP study, statistically significant increases in Schwannomas of the heart in male rodents exposed to the highest dose, and Schwann-cell hyperplasia in the heart in male and female rodents were observed (30). A non-statistically significant increase in malignant glial tumors in female rodents also was detected. These findings with far field exposure to RFR are consistent with and reinforce the results of the NTP study on near field exposure. Both reported an increase in the incidence of tumors of the brain and heart in RFR-exposed Sprague-Dawley rats, which are tumors of the same histological type as those observed in some epidemiological studies on cell phone users.

Further, in a 2015 animal carcinogenicity study, tumor promotion by exposure of mice to RFR at levels below exposure limits for humans was demonstrated (31). Co-carcinogenicity of RFR was also demonstrated by Soffritti and Giuliani (32) who examined both power-line frequency magnetic fields as well as 1.8 GHz modulated RFR. They found that exposure to Sinusoidal-50 Hz Magnetic Field (S-50 Hz MF) combined with acute exposure to gamma radiation or to chronic administration of formaldehyde in drinking water induced a significantly increased incidence of malignant tumors in male and female Sprague Dawley rats. In the same report, preliminary results indicate higher incidence of malignant Schwannoma of the heart after exposure to RFR in male rats. Given the ubiquity of many of these co-carcinogens, this provides further evidence to support the recommendation to reduce the public's exposure to RFR to as low as is reasonably achievable.

Finally, a case series highlights potential cancer risk from cell phones carried close to the body. West et al. (33) reported four "extraordinary" multifocal breast cancers that arose directly under the antennae of the cell phones habitually carried within the bra, on the sternal side of the breast (the opposite of the norm). We note that case reports can point to major unrecognized hazards and avenues for further investigation, although they do not usually provide direct causal evidence.

In a study of four groups of men, of which one group did not use mobile phones, it was found that DNA damage indicators in hair follicle cells in the ear canal were higher in the RFR exposure

groups than in the control subjects. In addition, DNA damage increased with the daily duration of exposure (34).

Many profess that RFR cannot be carcinogenic as it has insufficient energy to cause direct DNA damage. In a review, Vijayalaxmi and Prihoda (35) found some studies suggested significantly increased damage in cells exposed to RF energy compared to unexposed and/or sham-exposed control cells, others did not. Unfortunately, however, in grading the evidence, these authors failed to consider baseline DNA status or the fact that genotoxicity has been poorly predicted using tissue culture studies (36). As well funding, a strong source of bias in this field of enquiry, was not considered (37).

CHILDREN AND REPRODUCTION

As a result of rapid growth rates and the greater vulnerability of developing nervous systems, the long-term risks to children from RFR exposure from cell phones and other WTDs are expected to be greater than those to adults (38). By analogy with other carcinogens, longer opportunities for exposure due to earlier use of cell phones and other WTDs could be associated with greater cancer risks in later life.

Modeling of energy absorption can be an indicator of potential exposure to RFR. A study modeling the exposure of children 3–14 years of age to RFR has indicated that a cell phone held against the head of a child exposes deeper brain structures to roughly double the radiation doses (including fluctuating electrical and magnetic fields) per unit volume than in adults, and also that the marrow in the young, thin skull absorbs a roughly 10-fold higher local dose than in the skull of an adult male (39). Thus, pediatric populations are among the most vulnerable to RFR exposure.

The increasing use of cell phones in children, which can be regarded as a form of addictive behavior (40), has been shown to be associated with emotional and behavioral disorders. Divan et al. (41) studied 13,000 mothers and children and found that prenatal exposure to cell phones was associated with behavioral problems and hyperactivity in children. A subsequent Danish study of 24,499 children found a 23% increased odds of emotional and behavioral difficulties at age 11 years among children whose mothers reported any cell phone use at age 7 years, compared to children whose mothers reported no use at age 7 years (42). A cross-sectional study of 4,524 US children aged 8–11 years from 20 study sites indicated that shorter screen time and longer sleep periods independently improved child cognition, with maximum benefits achieved with low screen time and age-appropriate sleep times (43). Similarly, a cohort study of Swiss adolescents suggested a potential adverse effect of RFR on cognitive functions that involve brain regions mostly exposed during mobile phone use (44). Sage and Burgio et al. (45) posit that epigenetic drivers and DNA damage underlie adverse effects of wireless devices on childhood development.

RFR exposure occurs in the context of other exposures, both beneficial (e.g., nutrition) and adverse (e.g., toxicants or stress). Two studies identified that RFR potentiated adverse effects of lead on neurodevelopment, with higher maternal use of mobile phones during pregnancy [1,198 mother-child pairs, (46)] and

Attention Deficit Hyper-activity Disorder (ADHD) with higher cell phone use and higher blood lead levels, in 2,422 elementary school children (47).

A study of Mobile Phone Base Station Tower settings adjacent to school buildings has found that high exposure of male students to RFR from these towers was associated with delayed fine and gross motor skills, spatial working memory, and attention in adolescent students, compared with students who were exposed to low RFR (48). A recent prospective cohort study showed a potential adverse effect of RFR brain dose on adolescents' cognitive functions including spatial memory that involve brain regions exposed during cell phone use (44).

In a review, Pall (49) concluded that various non-thermal microwave EMF exposures produce diverse neuropsychiatric effects. Both animal research (50–52) and human studies of brain imaging research (53–56) indicate potential roles of RFR in these outcomes.

Male fertility has been addressed in cross-sectional studies in men. Associations between keeping cell phones in trouser pockets and lower sperm quantity and quality have been reported (57). Both *in vivo* and *in vitro* studies with human sperm confirm adverse effects of RFR on the testicular proteome and other indicators of male reproductive health (57, 58), including infertility (59). Rago et al. (60) found significantly altered sperm DNA fragmentation in subjects who use mobile phones for more than 4 h/day and in particular those who place the device in the trousers pocket. In a cohort study, Zhang et al. (61) found that cell phone use may negatively affect sperm quality in men by decreasing the semen volume, sperm concentration, or sperm count, thus impairing male fertility. Gautam et al. (62) studied the effect of 3G (1.8–2.5 GHz) mobile phone radiation on the reproductive system of male Wistar rats. They found that exposure to mobile phone radiation induces oxidative stress in the rats which may lead to alteration in sperm parameters affecting their fertility.

RELATED OBSERVATIONS, IMPLICATIONS AND STRENGTHS OF CURRENT EVIDENCE

An extensive review of numerous published studies confirms non-thermally induced biological effects or damage (e.g., oxidative stress, damaged DNA, gene and protein expression, breakdown of the blood-brain barrier) from exposure to RFR (63), as well as adverse (chronic) health effects from long-term exposure (64). Biological effects of typical population exposures to RFR are largely attributed to fluctuating electrical and magnetic fields (65–67).

Indeed, an increasing number of people have developed constellations of symptoms attributed to exposure to RFR (e.g., headaches, fatigue, appetite loss, insomnia), a syndrome termed *Microwave Sickness* or *Electro-Hyper-Sensitivity* (EHS) (68–70).

Causal inference is supported by consistency between epidemiological studies of the effects of RFR on induction of human cancer, especially glioma and vestibular Schwannomas, and evidence from animal studies (8). The combined weight

of the evidence linking RFR to public health risks includes a broad array of findings: experimental biological evidence of non-thermal effects of RFR; concordance of evidence regarding carcinogenicity of RFR; human evidence of male reproductive damage; human and animal evidence of developmental harms; and limited human and animal evidence of potentiation of effects from chemical toxicants. Thus, diverse, independent evidence of a potentially troubling and escalating problem warrants policy intervention.

CHALLENGES TO RESEARCH, FROM RAPID TECHNOLOGICAL ADVANCES

Advances in RFR-related technologies have been and continue to be rapid. Changes in carrier frequencies and the growing complexity of modulation technologies can quickly render “yesterdays” technologies obsolete. This rapid obsolescence restricts the amount of data on human RFR exposure to particular frequencies, modulations and related health outcomes that can be collected during the lifespan of the technology in question.

Epidemiological studies with adequate statistical power must be based upon large numbers of participants with sufficient latency and intensity of exposure to specific technologies. Therefore, a lack of epidemiological evidence does not necessarily indicate an absence of effect, but rather an inability to study an exposure for the length of time necessary, with an adequate sample size and unexposed comparators, to draw clear conclusions. For example, no case-control study has been published on fourth generation (4G; 2–8 GHz) Long-term Evolution (LTE) modulation, even though the modulation was introduced in 2010 and achieved a 39% market share worldwide by 2018 (71).

With this absence of human evidence, governments must require large-scale animal studies (or other appropriate studies of indicators of carcinogenicity and other adverse health effects) to determine whether the newest modulation technologies incur risks, prior to release into the marketplace. Governments should also investigate short-term impacts such as insomnia, memory, reaction time, hearing and vision, especially those that can occur in children and adolescents, whose use of wireless devices has grown exponentially within the past few years.

The Telecom industry's fifth generation (5G) wireless service will require the placement of many times more small antennae/cell towers close to all recipients of the service, because solid structures, rain and foliage block the associated millimeter wave RFR (72). Frequency bands for 5G are separated into two different frequency ranges. Frequency Range 1 (FR1) includes sub-6 GHz frequency bands, some of which are bands traditionally used by previous standards, but has been extended to cover potential new spectrum offerings from 410 to 7,125 MHz. Frequency Range 2 (FR2) includes higher frequency bands from 24.25 to 52.6 GHz. Bands in FR2 are largely of millimeter wave length, these have a shorter range but a higher available bandwidth than bands in the FR1. 5G technology is being developed as it is also being deployed, with large arrays

of directional, steerable, beam-forming antennae, operating at higher power than previous technologies. 5G is not stand-alone—it will operate and interface with other (including 3G and 4G) frequencies and modulations to enable diverse devices under continual development for the “internet of things,” driverless vehicles and more (72).

Novel 5G technology is being rolled out in several densely populated cities, although potential chronic health or environmental impacts have not been evaluated and are not being followed. Higher frequency (shorter wavelength) radiation associated with 5G does not penetrate the body as deeply as frequencies from older technologies although its effects may be systemic (73, 74). The range and magnitude of potential impacts of 5G technologies are under-researched, although important biological outcomes have been reported with millimeter wavelength exposure. These include oxidative stress and altered gene expression, effects on skin and systemic effects such as on immune function (74). *In vivo* studies reporting resonance with human sweat ducts (73), acceleration of bacterial and viral replication, and other endpoints indicate the potential for novel as well as more commonly recognized biological impacts from this range of frequencies, and highlight the need for research before population-wide continuous exposures.

GAPS IN APPLYING CURRENT EVIDENCE

Current exposure limits are based on an assumption that the only adverse health effect from RFR is heating from short-term (acute), time-averaged exposures (75). Unfortunately, in some countries, notably the US, scientific evidence of the potential hazards of RFR has been largely dismissed (76). Findings of carcinogenicity, infertility and cell damage occurring at daily exposure levels—within current limits—indicate that existing exposure standards are not sufficiently protective of public health. Evidence of carcinogenicity alone, such as that from the NTP study, should be sufficient to recognize that current exposure limits are inadequate.

Public health authorities in many jurisdictions have not yet incorporated the latest science from the U.S. NTP or other groups. Many cite 28-year old guidelines by the *Institute of Electrical and Electronic Engineers* which claimed that “Research on the effects of chronic exposure and speculations on the biological significance of non-thermal interactions have not yet resulted in any meaningful basis for alteration of the standard” (77)².

Conversely, some authorities have taken specific actions to reduce exposure to their citizens (78), including testing and recalling phones that exceed current exposure limits.

While we do not know how risks to individuals from using cell phones may be offset by the benefits to public health of being able to summon timely health, fire and police emergency services, the findings reported above underscore the importance of evaluating potential adverse health effects from RFR exposure, and taking pragmatic, practical actions to minimize exposure.

We propose the following considerations to address gaps in the current body of evidence:

- As many claim that we should by now be seeing an increase in the incidence of brain tumors if RFR causes them, ignoring the increases in brain tumors summarized above, a detailed evaluation of age-specific, location-specific trends in the incidence of gliomas in many countries is warranted.
- Studies should be designed to yield the strongest evidence, most efficiently:
 - Population-based case-control designs can be more statistically powerful to determine relationships with rare outcomes such as glioma, than cohort studies. Such studies should explore the relationship between energy absorption (SAR³), duration of exposure, and adverse outcomes, especially brain cancer, cardiomyopathies and abnormal cardiac rhythms, hematologic malignancies, thyroid cancer.
 - Cohort studies are inefficient in the study of rare outcomes with long latencies, such as glioma, because of cost-considerations relating to the follow-up required of very large cohorts needed for the study of rare outcomes. In addition, without continual resource-consuming follow-up at frequent intervals, it is not possible to ascertain ongoing information about changing technologies, uses (e.g., phoning vs. texting or accessing the Internet) and/or exposures.
 - Cross-sectional studies comparing high-, medium-, and low-exposure persons may yield hypothesis-generating information about a range of outcomes relating to memory, vision, hearing, reaction-time, pain, fertility, and sleep patterns.
- Exposure assessment is poor in this field, with very little fine-grained detail as to frequencies and modulations, doses and dose rates, and peak exposures, particularly over the long-term. Solutions such as wearable meters and phone apps have not yet been incorporated in large-scale research.
- Systematic reviews on the topic could use existing databases of research reports, such as the one created by *Oceania Radiofrequency Science Advisory Association* (79) or EMF Portal (80), to facilitate literature searches.
- Studies should be conducted to determine appropriate locations for installation of antennae and other broadcasting systems; these studies should include examination of biomarkers of inflammation, genotoxicity, and other health indicators in persons who live at different radiuses around these installations. This is difficult to study in the general population because many people’s greatest exposure arises from their personal devices.
- Further work should be undertaken to determine the distance that wireless technology antennae should be kept away from humans to ensure acceptable levels of safety, distinguishing among a broad range of sources (e.g., from commercial transmitters to Bluetooth devices), recognizing that exposures fall with the inverse of the square of the distance

²The FCC adopted the IEEE C95.1 1991 standard in 1996.

³When necessary, SAR values should be adjusted for age of child in W/kg.

(The inverse-square law specifies that intensity is inversely proportional to the square of the distance from the source of radiation). The effective radiated power from cell towers needs to be regularly measured and monitored.

POLICY RECOMMENDATIONS BASED ON THE EVIDENCE TO DATE

At the time of writing, a total of 32 countries or governmental bodies within these countries⁴ have issued policies and health recommendations concerning exposure to RFR (78). Three U.S. states have issued advisories to limit exposure to RFR (81–83) and the *Worcester Massachusetts Public Schools* (84) voted to post precautionary guidelines on Wi-Fi radiation on its website. In France, Wi-Fi has been removed from pre-schools and ordered to be shut off in elementary schools when not in use, and children aged 16 years or under are banned from bringing cell phones to school (85). Because the national test agency found 9 out of 10 phones exceeded permissible radiation limits, France is also recalling several million phones.

We therefore recommend the following:

1. Governmental and institutional support of data collection and analysis to monitor potential links between RFR associated with wireless technology and cancers, sperm, the heart, the nervous system, sleep, vision and hearing, and effects on children.
2. Further dissemination of information regarding potential health risk information that is in wireless devices and manuals is necessary to respect users' *Right To Know*. Cautionary statements and protective measures should be posted on packaging and at points of sale. Governments should follow the practice of France, Israel and Belgium and mandate labeling, as for tobacco and alcohol.
3. Regulations should require that any WTD that could be used or carried directly against the skin (e.g., a cell phone) or in close proximity (e.g., a device being used on the lap of a small child) be tested appropriately as used, and that this information be prominently displayed at point of sale, on packaging, and both on the exterior and within the device.
4. IARC should convene a new working group to update the categorization of RFR, including current scientific findings

⁴Argentina, Australia, Austria, Belgium, Canada, Chile, Cyprus, Denmark, European Environmental Agency, European Parliament, Finland, France, French Polynesia, Germany, Greece, Italy, India, Ireland, Israel, Namibia, New Zealand, Poland, Romania, Russia, Singapore, Spain, Switzerland, Taiwan, Tanzania, Turkey, United Kingdom, United States.

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that highlight, in particular, risks to youngsters of subsequent cancers. We note that an IARC Advisory Group has recently recommended that RFR should be re-evaluated by the IARC Monographs program with high priority.

5. The World Health Organization (WHO) should complete its long-standing RFR systematic review project, using strong modern scientific methods. National and regional public health authorities similarly need to update their understanding and to provide adequate precautionary guidance for the public to minimize potential health risks.
6. Emerging human evidence is confirming animal evidence of developmental problems with RFR exposure during pregnancy. RFR sources should be avoided and distanced from expectant mothers, as recommended by physicians and scientists (babysafeproject.org).
7. Other countries should follow France, limiting RFR exposure in children under 16 years of age.
8. Cell towers should be distanced from homes, daycare centers, schools, and places frequented by pregnant women, men who wish to father healthy children, and the young.

Specific examples of how the health policy recommendations above, invoking the Precautionary Principle, might be practically applied to protect public health, are provided in the **Annex**.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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Conflict of Interest Statement: The authors declare that this manuscript was drafted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest, although subsequent to its preparation, DD became a consultant to legal counsel representing persons with glioma attributed to radiation from cell phones.

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ANNEX: EXAMPLES OF ACTIONS FOR REDUCING RFR EXPOSURE

1. Focus actions for reducing exposure to RFR on pregnant women, infants, children and adolescents, as well as males who might wish to become fathers.
2. Reduce, as much as possible, the extent to which infants and young children are exposed to RFR from Wi-Fi-enabled devices such as baby monitors, wearable devices, cell phones, tablets, etc.
3. Avoid placing cell towers and small cell antennae close to schools and homes pending further research and revision of the existing exposure limits. In schools, homes and the workplace, cable or optical fiber connections to the Internet are preferred. Wi-Fi routers in schools and daycares/kindergartens should be strongly discouraged and programs instituted to provide Internet access via cable or fiber.
4. Ensure that WTDs minimize radiation by transmitting only when necessary, and as infrequently as is feasible. Examples include transmitting only in response to a signal (e.g., accessing a router or querying a device, a cordless phone handset being turned on, or voice or motion activation). Prominent, visible power switches are needed to ensure that WTDs can be easily turned on only when needed, and off when not required (e.g., Wi-Fi when sleeping).
5. Lower permitted power densities in close proximity to fixed-site antennae, from “occupational” limits to exposure limits for the general public.
6. Update current exposure limits to be protective against the non-thermal effects of RFR. Such action should be taken by all health ministries and public health agencies, as well as industry regulatory bodies. Exposure limits should be based on measurements of RFR levels related to biological effects (2).
7. Ensure that advisories relating to cell phone use are placed in such a way that purchasers can find them easily, similar to the Berkeley Cell Phone “Right to Know” Ordinance (86).
8. Advise the public that texting and speaker mode are preferable to holding cell phones to the ear. Alternatively, use hands-free accessories for cell phones, including air tube headsets that interrupt the transmission of RFR.
9. When possible, keep cell phones away from the body (e.g., on a nearby desk, in a purse or bag, or on a mounted hands-free accessory in motor vehicles).
10. Delay the widespread implementation of 5G (and any other new technology) until studies can be conducted to assess safety. This includes a wide range of household and community-wide infrastructure WTDs and self-driving vehicles, as well as the building of 5G minicells.
11. Fiber-optic connections for the Internet should be made available to every home, office, school, warehouse and factory, when and where possible.

GLOSSARY

ALARA	As Low a level As Reasonably Achievable
CBTRUS	Central Brain Tumor Registry of the United States
CI	Confidence Interval
EMR	Electro Magnetic Radiation
IARC	International Agency for Research on Cancer
ICNIRP	International Commission on Non-Ionizing Radiation Protection
INEP	International Network for Epidemiology in Policy
LTE	Long-Term Evolution modulation
NTP	U.S. National Toxicology Program
OR	Odds Ratio
RFR	Radio-Frequency Radiation
SAR	Specific Absorption Rate
WTD	Wireless Transmitting Device

Report says wireless radiation may harm wildlife

- By Scott Wyland swyland@sfnewmexican.com
- Feb 5, 2022 Updated Feb 7, 2022

Timeline for wireless radiation oversight

1980s to 1996: The Environmental Protection Agency measures levels of wireless radiation in the U.S. and is tasked with developing safety limits. The agency issues findings in a 1984 report on biological effects and a 1986 report on environmental exposure levels.

1995: The EPA meets with the Federal Communications Commission and presents its plan to develop safety limits for the potentially harmful electromagnetic fields that wireless technologies produce.

1996: The EPA's research on EMFs is defunded. The agency



A cell tower off I-25 on Jan. 31.
Luis Sánchez Saturno/The New Mexican

Health researchers raised concerns in the 1990s about the possible harmful effects of wireless radiation from cellphones and towers,

closes is project measuring EMF levels in U.S. cities. The FCC adopts wireless radiation rules and safety limits proposed by industry-connected groups.

1999: The Food and Drug Administration asks the National Toxicology Program to study cellphone radiation because of the lack of safety data on the health effects from long-term exposure.

2008: The National Research Council issues a report called “The Identification of Research Needs Relating to Potential Biological or Adverse Health Effects of Wireless Communications Devices.” Congress holds a hearing on the health effects of cellphone use.

2009: The U.S. Senate holds hearings on the health effects of cellphones' wireless radiation.

2012: A Government Accountability Office report recommends cellphone test procedures be reassessed to ensure they reflect real world use and are based on the latest science.

2013: The FCC opens an official inquiry asking if wireless radiation limits should be updated. Thousands of pages of scientific evidence are submitted

and their warnings met pushback from telecommunications companies on the verge of growing a mega-industry.

Industry-backed researchers assured federal agencies health concerns — especially those centered on the possibility of low-level microwaves causing cancer — lacked conclusive evidence.

Regulators accepted their assessments, and the alarm bells went silent.

Now a trio of researchers have compiled a report saying the widespread installation of cell towers and antennas is generating electromagnetic fields — EMFs for short — that could be physiologically harmful.

The report focuses on potential impacts on wildlife, trees, plants and insects, such as bees, because there are no regulations protecting them from EMFs emanating from wireless antennas. Wildlife protections are becoming more vital as this radiation — known more specifically as radiofrequency EMFs — escalates through 5G technologies, the researchers warn.

“There needs to be regulatory standards to address EMFs affecting wildlife,” said Albert Manville, a retired U.S. Fish and Wildlife Service biologist and one of the paper’s authors.

Manville also is an adjunct science professor at Johns Hopkins University.

to the FCC for its inquiry.

2019: The FCC issues a decision not to update the 1996 standards.

2020: The Environmental Health Trust files a petition against the FCC arguing the 2019 decision was not based on an adequate review of the data submitted.

2021: The U.S Court of Appeals in Washington, D.C., rules the FCC must review its 1996 guidelines and justify why they shouldn't be updated.

Source: [Environmental Health Trust](#)

He said he provided the Federal Communications Commission with some research on how the electromagnetic pollution can hurt wildlife and the steps that could be taken to lessen the impacts.

But the FCC has been unresponsive, Manville said, arguing the agency tends to accommodate the industry it's supposed to regulate.

"That's unfortunate, but that's just the way it is," he said.

The FCC did not respond to questions about whether it would consider making efforts to reduce animals' EMF exposure.

The three authors drew from 1,200 peer-reviewed studies to compile a three-part, 210-page report titled "Effects of non-ionizing electromagnetic fields on flora and fauna." It was published in the journal *Reviews on Environmental Health*.

Science journalist Blake Levitt, lead author of the report, said they dug up overlooked studies that contained compelling research on how living organisms react to low-level EMFs. Their compilation invalidates any claims that the EMFs don't cause biological effects, she said.

"We just blew the whole thing out of the water and took it to the ecosystem level, which is really where it needed to go," Levitt said. "Nobody had done that before. We need a whole lot more scrutiny put to the low-intensity stuff."

Ambient EMFs have risen exponentially in the past quarter-century, as cellphones were widely adopted, to become a ubiquitous and continuous environmental pollutant, even in remote areas, the

report said, adding studies indicate EMFs can affect animals' orientation, migration, food finding, reproduction, nest building, territorial defense, vitality, longevity and survival.

EMFs' toxic effects on an animal's cells, DNA and chromosomes have been observed in laboratory specimens — and thus would apply to wildlife, according to the report.

Many types of wildlife are exposed to EMFs from wireless sources, such as deer, seals, whales, birds, bats, insects, amphibians and reptiles, the report said. Many species have been found more sensitive to EMFs than humans in some ways.

The report recommends new laws that include the redesign of wireless devices and infrastructure to reduce the rising ambient levels.

It comes several months after a federal court in Washington, D.C., [ordered the FCC to review its guidelines for wireless radiation](#) and justify why it should retain them, as the standards haven't been updated since 1996. This radiation should not be confused with radioactivity, the court noted, adding microwaves used in transmitting signals are low enough to not heat tissues in what are known as "thermal effects."

But medical studies suggest the lower-level radiation could cause cancer, reproductive problems, impaired learning and motor skills, disrupted sleep and decreased memory.

These studies and others were submitted to the FCC after it opened a notice of inquiry in 2013 under the administration of former President Barack Obama to probe the adequacy of the 1996 guidelines, which were geared toward avoiding thermal effects, the court said.

In 2019, the Trump administration's FCC deemed the inquiry unnecessary, saying the 1996 rules were sufficient and required no revision.

Two judges called that FCC action "arbitrary and capricious," saying the FCC made the decision out of hand, ignoring all the science presented and offering no reasonable, fact-based argument to back it up.

Santa Fe New Mexican, [Report says wireless radiation may harm wildlife](#) by Scott Wyland 2/07/2022

The agency also failed to look at the technological developments in the past 25 years and how they've changed the degree of exposure, the judges wrote. And they said it refused to examine possible health effects from EMFs that fall below the threshold set in 1996.

“When an agency in the commission’s position is confronted with evidence that its current regulations are inadequate or the factual premises underlying its prior judgment have eroded, it must offer more to justify its decision to retain its regulations than mere conclusory statements,” the judges wrote.

“Rather, the agency must provide ‘assurance that [it] considered the relevant factors,’ ” they added.

The FCC’s reluctance to ensure wireless transmissions are safe for human health extends to wildlife, even as 5G technology gains momentum, said Theodora Scarato, executive director of the Environmental Health Trust, a nonprofit think tank that led the petition against the FCC.

Scarato said her group is promoting the wildlife report to fill a crucial gap in wireless oversight.

She plans to submit the report to the FCC as it conducts its new review of wireless radiation, with the hope the report will go on the record and be considered when crafting future rules.

Regulators need to determine how much EMFs must be curbed to safeguard flora and fauna, she said.

“What is a limit for a person is going to be different” than for animals, Scarato said.

The study notes EMFs can disrupt the Earth’s natural magnetic fields that birds, cats, fish and other animals use to navigate and orient themselves.

Towers keep the EMFs away from people on the ground but leave birds vulnerable because they fly near the transmitters and even perch on them, Scarato said.

“Air needs to be designated as habitat,” she said. “And EMFs need to be regulated like other pollutants.”

The transmissions can disorient bees, causing them to become lost, not return to their hives and die, Manville said.

The bees are already threatened by pesticides and climate change, he said. “It’s death by a thousand cuts.”

If they have a mass die-off, it could be disastrous for growers that depend on them to pollinate crops, he added.

Manville said as a federal biologist, he pushed to get the Interior Department to establish an environmental review that covered how new sources of wireless radiation would affect wildlife. Interior officials were receptive in 2014, but his proposal stalled at the Commerce Department, which was in charge of internet technology, he said. Then later, the Trump administration scrapped it.

Scarato said this “landmark paper” could be the catalyst for creating wildlife guidelines.

“The challenge before us is there isn’t an environmental agency who’s even looking at the science at this time,” she said. The study’s authors “make the case for regulations that we need.”

Scott Wyland

Reporter

Wildlife Review Scientific References

Levitt BB, Lai HC, Manville AM. [Effects of non-ionizing electromagnetic fields on flora and fauna, Part 3. Exposure standards, public policy, laws, and future directions.](#) Rev Environ Health. 2021 Sep 27. doi: 10.1515/reveh-2021-0083. Epub ahead of print. PMID: 34563106.

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Santa Fe New Mexican, [Report says wireless radiation may harm wildlife](#) by Scott Wyland 2/07/2022

To the President's Council of Environmental Justice:

I am a resident of Hartford, CT, which is an environmental justice city, and a member of the Hartford Coalition for Safe Technology, which has also submitted a comment. I object to the way the installation of the 5G network of small cell antennas has been accomplished in my area. Citizens have no voice in how and where the systems are installed.

There is no information about who (if anyone) is charged with maintaining the equipment or measuring the amount of radio frequency radiation that the small cells emit 24/7. Telecoms have to notify the owners of record of homes, buildings, apartments near the small cell installations. Hartford has a lot of renters and they are not required to be notified.

There are fiber optic networks installed underground throughout the city. These could be extended into homes, apartments, buildings, to offer a wired, and therefore safer and more secure, 5G service. Everyone wants to be connected to the internet. This can be unavailable to residents in lower income cities like Hartford. Use of existing fiber optic infrastructure could have lowered costs and helped in making it available. Yet for reasons known only to them a less safe, less secure method adding tons of equipment was chosen.

Sincerely,

Eileen Noonan

Environmental Health Trust EHTRUST.org

Wireless Radiation is an Environmental Justice Issue. It should be included in the metrics on environmental pollution injury. Please see resources below.

The Kids Are Not All Right

How Wireless Tech Is Harming Our Youth And What Parents Can Do Right Now

Alison Main



“Children are not little adults and are disproportionately impacted by all environmental exposures, including cell phone radiation. Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children.”

—American Academy of Pediatrics, 2013

Don't run with scissors. Don't talk to strangers. Don't play with matches. Don't drink and drive. Don't do drugs.

Parents are eternally concerned about their children's safety. From infancy to adolescence, children are developing humans—physically, behaviorally and intellectually. To emerge as healthy, well-adjusted adults, kids need their parents' protection. And when it comes to children and wireless-tech safety, there's a lot parents need to know.

What is Wi-Fi, Really?

We can't see Wi-Fi with the naked eye—but we're surrounded by it, 24/7. Wireless technology encompasses our cell phones, tablets, cell towers, smart meters, wireless-enabled laptops, baby monitors, gaming consoles, e-readers, virtual-reality toys and the emerging Internet of Everything.

The term “Wi-Fi” sounds harmless enough, right? Its utterance like a baby's coo or cartoon slang. It alliteratively conjures “Sci-Fi” flying cars and time travel. But let's call wireless tech what it really is—radiofrequency radiation, also called microwave radiation.

Technically speaking, “Wi-Fi deploys pulse-modulated microwave radiation (within the larger radiofrequency spectrum) with a carrier frequency that is similar to that used by a microwave oven (about 2.45 gigahertz).”⁵ In 2011, the International Agency for Research on Cancer classified radiofrequency radiation as “possibly carcinogenic to humans.” This is the same category as lead, DDT, and other pesticides.

Who's at Risk?

Science shows that wireless radiation can cause a gamut of biological effects, from cancer and neurodegenerative diseases to birth defects and infertility. And yet, outdated world-wide safety regulations only consider short-term heating (i.e., thermal) and shock effects. They don't consider the chronic, non-thermal exposures of our wireless tech world.²

As a human population, we are all at risk from environmental exposures and toxins. But, the most vulnerable are children, the developing fetus and pregnant women. A child's brain, nervous system and immune system are in development at these critical periods. Despite this, "there is a growing, unchecked and unregulated availability of a range of transmitting equipment specifically aimed at parents of babies and young people."²

Yes, this includes that wireless baby monitor (2 inches from your baby's head), that working cell phone in your toddler's mouth, or that tablet broadcasting under your teen's pillow—all these seemingly innocuous devices can be hazardous to your child's health.

AMERICAN ACADEMY OF PEDIATRICS CELL PHONE SAFETY TIPS FOR FAMILIES

- 1 Use text messaging when possible, and use cell phones in speaker mode or with the use of hands-free kits.
- 2 Avoid carrying your phone against the body like in a pocket, sock or bra. Cell phone manufacturers can't guarantee that the amount of radiation you're absorbing will be at a safe level.
- 3 If you plan to watch a movie on your device, download it first, then switch to airplane mode while you watch in order to avoid unnecessary radiation exposure.
- 4 Keep an eye on your signal strength (i.e., how many bars you have). The weaker your cell signal, the harder your phone has to work and the more radiation it gives off.
- 5 Avoid making calls in cars, elevators, trains and buses. The cell phone works harder to get a signal through metal, so the power level increases.
- 6 Remember that cell phones are not toys or teething items.

Read more tips at:
HealthyChildren.org

REFERENCE:

+American Academy of Pediatrics. "Cell Phone Radiation & Children's Health: What Parents Need to Know." <https://www.healthychildren.org/English/safety-prevention/all-around/Pages/Cell-Phone-Radiation-Childrens-Health.aspx>

"Around the world we are paying the price now for having delayed actions on tobacco and asbestos after insisting on human harm before taking action. We cannot afford to wait for definitive proof of human risks from radiation emitted by wireless transmitting devices before taking steps to reduce exposures. The absence of evidence of hazard is not proof of safety"—says Dr. Devra Davis, president of the Environmental Health Trust and visiting professor at the Hebrew University Hadassah Medical School and Ondokuz Mayıs University, Turkey.

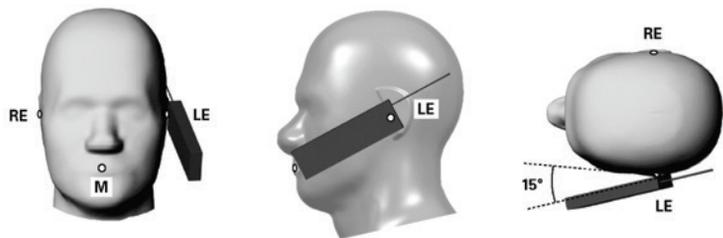
Who is SAM?

Standing for "Specific Anthropomorphic Mannequin," SAM is a plastic model of a head, which, in 1989, was made to represent the top 10 percent of U.S. military recruits. That's a 220-pound man with a pretty large head.

SAR, another relevant acronym, stands for "Specific Absorption Rate"—a measure of tissue-radiation exposure.⁹ The cell phone industry currently uses SAM for compliance testing against safety guidelines and to certify the SAR for mobile phone users.

However, research shows that a smaller head than SAM will absorb significantly more radiofrequency radiation.¹² Obviously, children's smaller heads have a shorter distance to the brain center. Also, children's skulls and ears are thinner, allowing radiation to penetrate farther. And children's brains contain more fluid, and thus absorb more radiation.^{4, 12}

The SAR for a 10-year-old is up to 153 percent higher than the SAR for the SAM model,¹ yet there is no pre-market certification testing for SAR on a child-equivalent head (or an adult's head smaller than SAM). And "when electrical properties are considered, a child's head's absorption can be over two times greater, and absorption of the skull's bone marrow can be 10 times greater than adults."¹



An example of a test position used on the Specific Anthropomorphic Mannequin, in this case with cell phone in tilted position on the left side.

+ <https://biomedical-engineering-online.biomedcentral.com/articles/10.1186/1475-925X-3-34>.

IMAGE SOURCE: BIOMED CENTRAL LTD

What Does the Latest Science Say?

In May 2016, the National Toxicology Program released partial findings of their \$25 million study on cell phones and cancer. The results showed that exposure to wireless radiation significantly increases the prevalence of highly malignant heart and brain cancers in rodents.

"The findings of brain tumors (gliomas) and malignant Schwann cell tumors of the heart in the NTP study, as well as DNA damage in brain cells of exposed animals, present a major public health concern because these tumors occurred in the same types of cells that had been reported to develop into tumors (gliomas and acoustic neuromas) in epidemiological studies of adult cell phone users,"

SHOW US THE FINE PRINT

Cell phone companies issue instructions to keep wireless devices at specified distances from our bodies. So, if you've got your mobile on your ear, or your tablet on your abdomen, you may be exposed to higher radiation levels than those tested as safe. But this information is often buried in the fine print, sometimes even buried in the device itself.

Here's a sampling of manufacturer instructions:

● **Baby Monitor Motorola MBP33**

"The Baby unit shall be installed and used such that parts of the user's body other than the hands are maintained at a distance of approximately 20 centimeters (8 inches) or more."

● **Samsung 3G Laptop**

"Usage precautions during 3G connection: Keep safe distance from pregnant women's stomach or from lower stomach of teenagers. Body worn operation: Important safety information regarding radiofrequency radiation exposure. To ensure compliance with radiofrequency exposure guidelines the Notebook PC must be used with a minimum of 20.8 centimeters antenna separation from the body."

● **iPhone 6**

"To reduce exposure to radiofrequency energy, use a hands-free option, such as the built-in speakerphone, the supplied headphones, or other similar accessories. Carry iPhone at least 5 millimeters away from your body to ensure exposure levels remain at or below the as tested levels. Cases with metal parts may change the radiofrequency performance of the device, including its compliance with radiofrequency exposure guidelines, in a manner that has not been tested or certified."

Find your device at:

ShowTheFinePrint.org

REFERENCE:

+Show Us The Fine Print. <http://showthefineprint.org/>

explains Ron Melnick, Ph.D., senior toxicologist and director of Special Programs in the Environmental Toxicology Program at the National Institute of Environmental Health Sciences, National Institutes of Health, now retired.

In response to these results, the American Academy of Pediatrics issued new recommendations for reducing exposure to cell phones and wireless devices. In an AAP press release, Jennifer A. Lowry—M.D. and chair of the AAP Council on Environmental Health Executive Committee—said: "They're not toys. They have radiation that is emitted from them and the more we can keep it off the body and use (the phone) in other ways, it will be safer."⁷

Microwave Tech in Schools

Computers and the Internet are vital learning tools. But the crux of the matter with wireless tech is safety. And this rampant technology has never been tested for the long-term, overlapping, cumulative exposures experienced in today's schools by the most vulnerable population: children.

Students in schools are bombarded with wireless radiation from every conceivable angle: their own personal devices, the devices of all nearby users in surrounding classrooms, wireless devices in the school itself (routers, printers, smart boards, etc.), and transmitters (i.e., cell towers) in close proximity outside the school. Plus, to simultaneously handle the hundreds of devices needed to conduct its daily activities, schools typically install stronger Wi-Fi systems. Most residential homes now have Wi-Fi hubs and multiple devices per household member—meaning that when kids return home, they get no respite.

"They're not toys. They have radiation that is emitted from them and the more we can keep it off the body and use (the phone) in other ways, it will be safer."

Consequently, in schools across the world, kids are getting sick from this unprecedented level of wireless exposure. Dafna Tachover, founder of We Are The Evidence—an advocacy group for those injured by wireless technology—is an attorney in both Israel and New York. She regularly works with children and parents who have developed electro-sensitivity to wireless tech. Symptoms commonly reported include: headaches, nausea, vomiting, cognitive problems, tingling, severe exhaustion, noise sensitivity, sinus pressure and nose bleeds.

In a case submitted to the Israeli Supreme Court, Tachover presented 200 children, from six schools, who had become sick from wireless tech. In one particular school, 70 children from three classes started having symptoms after a second wireless router was installed. Tachover uncompromisingly states: "Our school systems are creating the most intense environment of radiation, and they're doing it to the most sensitive population. The harm has already been proven. There's an epidemic of sickness in the schools."

After significant efforts, in April 2016 the city of Haifa, in Israel, ordered all Wi-Fi to be disconnected in schools. In a press release, Haifa's mayor, Yona Yahav, is cited saying, "When there is a doubt, when it comes to our children, there is no doubt."

This is a step in the right direction, but internationally there continue to exist countless groups of concerned parents and researchers urging school administrations to adopt best tech practices. Schools can get the same educational benefits from a *wired* (fiber-optic and Ethernet) network, and in doing so, they wouldn't be putting an entire generation of kids at risk.

There's No Wi-Fi in Narnia

Some schools are now rolling out virtual-reality curricula, like the Google Expeditions Pioneer Program. Sure, it sounds cool to take a trip to Mars without leaving the classroom. But, hold that virtual-reality visor up to a child's eyes, and what you've got is a cell phone encased in a cardboard box, beaming microwave radiation directly into a child's brain.

Whether used in school or at home, virtual-reality toys have never been pre-market tested for health consequences. Dr. Mary Redmayne, a researcher at Monash University in Australia, explains: "Children's brains are not fully myelinated and eyes absorb radiation readily due to their high water content. Placing a two-way microwave radiating device directly in front of young eyes is not a wise choice in my opinion."⁹

Schools can get the same educational benefits from a wired (fiber-optic and Ethernet) network, and in doing so, they wouldn't be putting an entire generation of kids at risk.

Theodora Scarato—Environmental Health Trust's director of Public Affairs and Educational Resources—speaks to another angle regarding digital play. "The research shows that simpler is often better in terms of toys. When you have a bunch of building blocks, then a child can use their own creativity to imagine what these blocks are. But when it's already pre-scripted, the child is using less creativity, because the choice has already been taken away. You can only be as creative as the program application is. And that is stifling. When I listen to children tell me about what they imagine in their minds, I'm always blown away. A computer's drop down menu can't even come close."

Tech Addiction

"A representative survey of American tweens (8- to 12-year-olds) and teens (13- to 18-year-olds), documented that outside of school and homework, tweens spend almost six hours per day (5:55 hours) and teens spend almost nine hours per day (8:56 hours) using media."¹¹

While "Tech Addiction" is not yet classified as a disorder in *The Diagnostic and Statistical Manual of Mental Disorders*, the phenomenon is nonetheless being investigated by a host of psychologists and researchers. Clinical psychologist Catherine Steiner Adair sheds light on the impact of the omnipresent glowing screen within the family dynamic: "Everything a baby needs from its environment between birth and 2 years comes from people, from relationships with people and interactions with the environment—physically exploring, playing, crawling, and interacting with others. When we triangulate our relationship with our babies and tech, we compromise that essential connection."¹⁰

Further, "the development of empathy is a critical step in early childhood and over a lifetime. Empathy is the caring glue that creates our humanity, our compassion."¹⁰ We learn empathy through direct human contact. This is thwarted when kids correlate personal identity with their Xbox avatar or their Facebook status. The blood in Halo isn't real; sad-face emojis aren't tears. When disconnected from real-life interaction, kids don't learn accountability for negative actions or mean words. What kind of society will emerge when our technology-obsessed youth is decoupled from the tangibility of human consequences?

Like a Kid in a Candy Store

An apt allegory might be Roald Dahl's *Charlie and the Chocolate Factory*. Faced with his tempting, addictive, untested, fantastical inventions, the story's overindulgent kids were squeezed, colorized, ballooned and miniaturized, while their parents stood idly by and watched—all for Mr. Wonka's industrial benefit and profit.

Kids today should not literally be left to their own devices. The proliferation of wireless radiation is the biggest public health experiment ever conducted, and it's happening on an entire generation of children. Do you want to experiment on your kids?

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10 STEPS FOR PREGNANT WOMEN TO LIMIT THEIR WIRELESS RADIATION EXPOSURE:

- 1 Avoid carrying your cell phone on your body.
- 2 Avoid holding any wireless device against your body when in use.
- 3 Use your cell phone on speaker setting or with an "air tube" headset.
- 4 Avoid using your wireless device in cars, trains or elevators.
- 5 Avoid cordless phones, especially where you sleep.
- 6 Whenever possible, connect to the Internet with wired cables.
- 7 When using Wi-Fi, connect only to download, then disconnect and disable Wi-Fi.
- 8 Avoid prolonged or direct exposure to nearby Wi-Fi routers.
- 9 Unplug your home Wi-Fi router when not in use.
- 10 Sleep as far away from wireless utility meters (i.e., "smart meters") as possible.

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David Vela, Superintendent
Grand Teton National Park
John D. Rockefeller, Jr. Memorial Parkway

Re: Telecommunications Infrastructure Plan EA

Dear Mr. Vela & National Park Staff,

Environmental Health Trust (EHT) is a nonprofit Think Tank and policy organization dedicated to identifying and reducing environmental health hazards. EHT provides independent scientific research and advice on controllable environmental hazards to local, state and national governments. Today, we write to advise you of scientific grounds for major health and environmental concerns about the proposal for the installation of wireless telecommunications facilities and associated infrastructure at nine developed areas in the park and to express our grave concerns about this planned expansion of mobile communications in Grand Teton National Park. You may recall your discussions last year with me about the need to limit exposures to wildlife and fauna from wireless radiation that took place when we met as part of the City Kids final ascent of the Grand.

We fully recognize there is a need for communication for emergency purposes. We further recognize that the Park plays a unique role in our country and in our lives by providing a wilderness that is apart from the normal hectic life that many Americans lead today. We are deeply concerned that by expanding wireless communications this proposal will irrevocably impair the wilderness experience and that there are wired solutions that would be far less damaging.

The transmissions to and from these proposed microwave wireless installations will be emissions that are an environmental pollutant known to cause cancer (in both experimental animals and humans) and other adverse health and environmental effects (e.g., on birds, bees, trees) according to internationally recognized authoritative research, including studies conducted by the U.S. National Toxicology Program, which is the nation's premiere testing program.

In light of the scientific documentation showing harmful effects, EHT writes today to advise regarding technical scientific information on impacts to human health, wildlife and the environment, explaining why more than 240 expert scientists are calling for immediate reductions in exposures to microwave wireless radiation.

Documented Impacts to Wildlife and the Environment

We would like to make you aware that there is growing literature showing the adverse impacts of microwave radiation on animal and bird behavior and physiology, as well as plants and trees. As the Natural Resources Defense Council and the Public Employees for Environmental Responsibility have argued, an environmental impact

assessment should be performed before building these networks. Peer-reviewed [research](#) links EMF emissions to myriad adverse environmental and health effects. Environmental effects include disruptions to reproduction, development, orientation, and migration of animals,¹ and damage to plants and crops.²

Albert Manville, former U.S. Fish and Wildlife Service agency lead on avian-structural impacts, wrote “[A BRIEFING MEMORANDUM: What We Know, Can Infer, and Don’t Yet Know about Impacts from Thermal and Non-thermal Non-ionizing Radiation to Birds and Other Wildlife](#)”³ documenting the body of research and concluding:

“There is an increasing body of published laboratory research that finds DNA damage at low intensity exposures — well below levels of thermal heating — which may be comparable to far field exposures from cell antennas. This body of work would apply to all species, including migratory birds, since DNA is DNA, whether single-strand or double helix. The first study to find such effects was conducted by H. Lai and N.P. Singh in 1995 (Lai and Singh 1995). Their work has since been replicated (e.g., Lai and Singh 1996, as well as in hundreds of other more recent published studies), performed in at least 14 laboratories worldwide. The take-home message: low level transmission of EMF from cell towers and other sources probably causes DNA damage. The laboratory research findings strongly infer this relationship. Since DNA is the primary building block and genetic “map” for the very growth, production, replication and survival of all living organisms, deleterious effects can be critical.”

Please note the following published research studies.

- [“A review of the ecological effects of RF-EMF”](#) 2013 review of 113 published studies found in 65% of the studies (50% of the animal studies and about 75% of the plant studies) RF-EMF had a significant effect on birds, insects, other vertebrates, other organisms and plants ([Cucurachi 2013](#)). The review paper cites development and reproduction in birds and insects as the most strongly affected endpoints.⁴

¹ See, e.g., Kimmel, Stefan, et al. [“Electromagnetic radiation: influences on honeybees \(*Apis mellifera*\).”](#) *IIAS-InterSymp Conference*, 2007 (finding that 39.7% of the non-irradiated bees had returned to their hives compared to only 7.3% of the irradiated bees); Cucurachi, C., et al. [“A review of the ecological effects of radiofrequency electromagnetic fields \(RF-EMF\).”](#) *Environment International*, vol. 51, 2013, pp. 116–40; [“Briefing Paper on the Need for Research into the Cumulative Impacts of Communication Towers on Migratory Birds and Other Wildlife in the United States.”](#) *Division of Migratory Bird Management (DMBM)*, U.S. Fish & Wildlife Service, 2009; Balmori, A. [“Mobile phone mast effects on common frog \(*Rana temporaria*\) tadpoles.”](#) *Electromagnetic Biology and Medicine*, vol. 29, no. 1-2, 2010, pp. 31-5; Harkless, Ryan, Muntather Al-Quraishi and Mary C. Vagula. [“Radiation hazards of radio frequency waves on the early embryonic development of Zebrafish.”](#) *SPIE Proceedings*, vol. 9112, 2014.

² See, e.g., Waldmann-Selsam, C., et al. [“Radiofrequency radiation injures trees around mobile phone base stations.”](#) *Science of the Total Environment*, vol. 572, 2016, pp. 554-69; Halgamuge, M.N. [“Weak radiofrequency radiation exposure from mobile phone radiation on plants.”](#) *Electromagnetic Biology and Medicine*, vol. 36, no. 2, 2017, pp. 213-235; Halgamuge, Malka N., See Kye Yak and Jacob L. Eberhardt. [“Reduced growth of soybean seedlings after exposure to weak microwave radiation from GSM 900 mobile phone and base station.”](#) *Bioelectromagnetics*, vol. 36, no. 2, 2015, pp. 87-95; Haggerty, Katie. [“Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings.”](#) *International Journal of Forestry Research*, vol 2010, no. 836278, 2010.

³ Manville, Albert M. [“A BRIEFING MEMORANDUM: What We Know, Can Infer, and Don’t Yet Know about Impacts from Thermal and Non-thermal Non-ionizing Radiation to Birds and Other Wildlife.”](#) *Wildlife and Habitat Conservation Solutions*, 2014.

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- A 2012 Review “[Impacts of radio-frequency electromagnetic field \(RF-EMF\) from cell phone towers and wireless devices on biosystem and ecosystem – A Review](#)” on 919 research papers found 593 showed impacts, 180 showed no impacts, and 196 were inconclusive studies.”⁵
- Studies on bees have found behavioral effects ([Kumar 2011](#)⁶, [Favre 2011](#)⁷), disrupted navigation ([Goldsworthy 2009](#)⁸, [Sainudeen 2011](#)⁹, [Kimmel et al. 2007](#)¹⁰), decreasing egg-laying rate ([Sharma and Kumar, 2010](#)¹¹) and reduced colony strength after RF exposures ([Sharma and Kumar, 2010](#), [Harst et al. 2006](#)¹²).
- A study focusing on RF from cellular antennas found increased sperm abnormalities in mice exposed to RF from GSM antennas ([Otitoloju 2010](#)).¹³
- “[Exposure of Insects to Radio-Frequency Electromagnetic Fields from 2 to 120 GHz](#)” published in Scientific Reports is the first study to investigate how insects (including the Western honeybee) absorb the higher frequencies (2 GHz to 120 GHz) to be used in the 4G/5G rollout. The scientific simulations showed increases in absorbed power between 3% to 370% when the insects were exposed to the frequencies. Researchers concluded, “This could lead to changes in insect behavior, physiology, and morphology over time....”¹⁴
- Researchers published a study on [frogs](#) in Electromagnetic Biology and Medicine exposing eggs and tadpoles to electromagnetic radiation from cell phone antennas for two months, from the egg phase until an advanced phase of tadpole and found low coordination of movements, an asynchronous growth, resulting in both big and small tadpoles, and a high mortality rate. The authors conclude, “these results indicate that radiation emitted by phone masts in a real situation may affect the development and may cause an increase in mortality of exposed tadpoles.”¹⁵

We also want to bring your attention to the growing body of literature showing the impacts on trees and plants. Here again, experimental literature has found that rhizomes, nitrification and other critical processes to plant growth and health are affected by cell phone like radiation under controlled conditions. There have been over one hundred studies that have shown this and most recently a [field study](#)¹⁶ that showed under controlled conditions, trees that are

⁵ S Sivani*, D Sudarsanam, [Impacts of radio-frequency electromagnetic field \(RF-EMF\) from cell phone towers and wireless devices on biosystem and ecosystem – a review](#), *Biology and Medicine*, 4 (4): 202–216, 2012.

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¹⁶ Cornelia Waldmann-Selsam, Alfonso Balmori-de la Puente, Helmut Breunig, Alfonso Balmori,

closer to cell phone towers start to die more readily; and this can be seen if one looks at the branches of the trees closest to the antennae of the cell phone tower with the fake tree at the Stilson parking lot off Hwy 390.

Please note these published studies:

- A field monitoring study spanning 9 years involving over 100 trees ([Waldmann-Selsam 2016](#))¹⁷ found trees sustained significantly more damage on the side of the tree facing the antenna, leaving the entire tree system prone to degradation over time. Documentation of tree damage from base stations is made visible in the Report “Tree Damage Caused by Mobile phone base stations” ([Breunig, 2017](#)).¹⁸
- A study on Aspen trees near Lyons, Colorado entitled “[Adverse Influence of Radio Frequency Background on Trembling Aspen Seedlings](#)” published in the *International Journal of Forestry* found adverse effects on growth rate and fall anthocyanin production concluding that, “results of this preliminary experiment indicate that the RF background may be adversely affecting leaf and shoot growth and inhibiting fall production of anthocyanins associated with leaf senescence in trembling aspen seedlings. These effects suggest that exposure to the RF background may be an underlying factor in the recent rapid decline of aspen populations. Further studies are underway to test this hypothesis in a more rigorous way.”¹⁹
- An analysis of 45 peer-reviewed scientific publications (1996-2016) on changes in plants due to the non-thermal RF-EMF effects from mobile phone radiation entitled “[Weak radiofrequency radiation exposure from mobile phone radiation on plants](#)” concludes, “Our analysis demonstrates that the data from a substantial amount of the studies on RF-EMFs from mobile phones show physiological and/or morphological effects (89.9%, $p < 0.001$). Additionally, our analysis of the results from these reported studies demonstrates that the maize, roselle, pea, fenugreek, duckweeds, tomato, onions and mungbean plants seem to be very sensitive to RF-EMFs. Our findings also suggest that plants seem to be more responsive to certain frequencies...”²⁰

Electromagnetic Fields Alter Animal and Insect Orientation

Science of the Total Environment published environmental scientist Alfonso Balmori’s “[Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation](#),” which states, “Current evidence indicates that exposure at levels that are found in the environment (in urban areas and near base stations) may particularly alter the receptor organs to orient in the magnetic field of the earth. These results could have important implications for migratory birds and insects, especially in urban areas, but could also apply to birds and insects in

[Radiofrequency radiation injures trees around mobile phone base stations](#), *Science of The Total Environment*, Volume 572, 2016, Pages 554-569, ISSN 0048-9697, doi.org/10.1016/j.scitotenv.2016.08.045.

¹⁷ Cornelia Waldmann-Selsam, Alfonso Balmori-de la Puente, Helmut Breunig, Alfonso Balmori, [Radiofrequency radiation injures trees around mobile phone base stations](#), *Science of The Total Environment*, Volume 572, 2016, Pages 554-569, ISSN 0048-9697, doi.org/10.1016/j.scitotenv.2016.08.045.

¹⁸ Breunig, Helmut, [Tree damage caused by mobile phone base stations An observation guide](#), 2017.

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²⁰ Malka N. Halgamuge (2017) [Review: Weak radiofrequency radiation exposure from mobile phone radiation on plants](#), *Electromagnetic Biology and Medicine*, 36:2, 213-235, DOI: 10.1080/15368378.2016.1220389.

natural and protected areas where there are powerful base station emitters of radiofrequencies. Therefore, more research on the effects of electromagnetic radiation in nature is needed to investigate this emerging threat.”²¹

Multiple research studies have documented how animals magnetoreception can be disrupted by external electromagnetic fields from [mice](#)²² to [cows](#) to [dogs](#) to [birds](#).²³ Electromagnetic exposure is especially disruptive to migratory birds.²⁴ Electromagnetic fields have been shown to disrupt the magnetic compass orientation used by birds to navigate.^{25,26} Researchers have suggested this disruption of magnetoreception is due to cryptochrome photoreceptors that allow birds to use built-in receptors as a biological compass.

In 2012 the government of India’s Ministry of the Environment and Forest issued a [report](#) on the potential impacts of communication towers on wildlife, citing hundreds of research studies that found adverse effects. Recommendations from the Ministry include, “Introduce a law for protection of urban flora and fauna from emerging threats like ERM/EMF as conservation issues in urban areas are different from forested or wildlife habitats.”²⁷

A [2017 report to UNESCO](#)²⁸ by botanist Mark Broomhall details the association between increasing amounts of electromagnetic radiation from cellular antennas on the Mt. Nardi tower complex and species disappearance and exodus from the Mt. Nardi area of the Nightcap National Park World Heritage Area during a 15-year period (2000-2015). He estimates “in both volume and species that from 70 to 90 % of the wildlife has become rare or has disappeared from the Nightcap National Park within a radius of the Mt. Nardi tower complex. This statement can be summarised with concrete data: 3 bat species once common have become rare or gone, 11 threatened and endangered bird species are gone, 11 migratory bird species are gone, 86 bird species are demonstrating unnatural behaviours, 66 once common bird species are now rare or gone.” The Report concludes, “With these short explanations of events we can appreciate that the effects of this technology and its application on Mt. Nardi over the last fifteen years, affect not only the top of the life chain species but they are devastating the fabric of the continuity of the World Heritage, causing genetic deterioration in an insidious, massive and ever escalating scale. To truly understand what these studies reveal is to stare into the abyss.”

²¹ Alfonso Balmori, [Anthropogenic radiofrequency electromagnetic fields as an emerging threat to wildlife orientation](#), *Science of The Total Environment*, Volumes 518–519, 2015, Pages 58-60, ISSN 0048-9697, doi.org/10.1016/j.scitotenv.2015.02.077.

²² Malkemper, E.P., et al. [“Magnetoreception in the wood mouse \(Apodemus sylvaticus\): influence of weak frequency-modulated radio frequency fields.”](#) *Scientific Reports*, vol. 4, no. 9917, 2015.

²³ Wiltshko Roswitha, Thalau Peter, Gehring Dennis, Nießner Christine, Ritz Thorsten, Wiltshko Wolfgang. [Magnetoreception in birds: the effect of radio-frequency fields](#).12. *Journal of The Royal Society Interface*.

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²⁷ Expert Committee, Ministry of Environment and Forest, Government of India, [Report on Possible Impacts of Communication Towers on Wildlife Including Birds and Bees](#), Constituted on 30th August, 2010.

²⁸ Broomhall, Mark. [“Reporting detailing the exodus of species from the Mt. Nardi area of the Nightcap National Park World Heritage Area during a 15-year period \(2000-2015.\)”](#) United Nations Scientific and Cultural Organization (2017).

It is very important that in considering antenna placement, there be a full environmental assessment on migratory animal patterns (from the smallest to the largest) and not simply on birds and mammals like the pronghorn but also on impacts to amphibians and insects.

Wireless Radiation is Known to Harm Humans and Wildlife

Human health effects include impaired reproduction, increased incidence of brain cancer, DNA breaks, oxidative stress and immune dysfunction, altered brain development, sleep changes, hyperactivity, and memory and cognitive problems.²⁹ Since the WHO/IARC [classified EMF as a Group 2B Possible Carcinogen](#) in 2011, the peer-reviewed research connecting wireless exposure to cancer has significantly strengthened and several scientists have published documentation that the weight of current peer-reviewed evidence supports the conclusion that radiofrequency radiation should be regarded as a human carcinogen.^{30,31,32}

- The 10 year \$30 million National Institute of Environmental Health Sciences National Toxicology Program's (NTP) Studies of the Toxicology and Carcinogenicity of Cell Phone Radiation^{33,34} found that RFR was associated with "clear evidence" of cancer due to the increased malignant schwannomas found in RFR-exposed male rats. The brain (glioma) cancers and tumors in the adrenal glands were also considered evidence of an association with cancer. In addition, exposed animals had significantly more DNA damage, heart damage, and low birth weight.
- The Ramazzini Institute published its [findings](#)³⁵ that animals exposed to very low-level RFR developed the same types of cancers as reported by the NTP.
- Long-term [research](#) on humans who have used cell phones has found increased tumors—schwannomas and glioblastomas—the same cell type as found in the NTP and Ramazzini Institute studies. Persons who started using cell phones under age 20 had the highest risk.³⁶
- A 2015 Jacobs University [study](#) (replicating a [2010 study](#)) found that weak cell phone signals significantly promote the growth of tumors in mice and that combining a toxic chemical exposure with RF more than doubled the tumor response.^{37,38}

²⁹ For more information on acute health symptoms, see, e.g., Martin Pall, Microwave Frequency Electromagnetic Fields (EMFs) Produce Widespread Neuropsychiatric Effects Including Depression, *75 J. Chemical Neuroanatomy* 43-51 (Sept. 2016); [Response of residents living in the vicinity of a cellular phone base station in France](#) ; [Electromagnetic Fields: A Hazard to Your Health2](#), Healthy Children.

³⁰ Adams, Jessica A., et al. ["Effect of mobile telephones on sperm quality: a systematic review and meta-analysis."](#) *Environment International*, 70, 2014, pp. 106-112.

³¹ Deshmukh, P.S., et al. ["Cognitive impairment and neurogenotoxic effects in rats exposed to low-intensity microwave radiation."](#) *International Journal of Toxicology*, vol. 34, no. 3, 2015, pp. 284-90.

³² Aldad, T.S., et al. ["Fetal Radiofrequency Radiation Exposure From 800-1900 MHz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice."](#) *Scientific Reports*, vol. 2, no. 312, 2012.

³³ National Toxicology Program, [Cell Phone Radio Frequency Radiation](#)

³⁴ [High exposure to radio frequency radiation associated with cancer in male rats](#)

³⁵ L. Falcioni, L. Bua, E. Tibaldi, M. Lauriola, L. De Angelis, F. Gnudi, D. Mandrioli, M. Manservigi, F. Manservigi, I. Manzoli, I. Menghetti, R. Montella, S. Panzacchi, D. Sgargi, V. Strollo, A. Vornoli, F. Belpoggi, [Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz GSM base station environmental emission](#), *Environmental Research*, Volume 165, 2018, Pages 496-503, ISSN 0013-9351, doi.org/10.1016/j.envres.2018.01.037.

³⁶ [https://www.pathophysiologyjournal.com/article/S0928-4680\(14\)00064-9/fulltext](https://www.pathophysiologyjournal.com/article/S0928-4680(14)00064-9/fulltext)

³⁷ Lerchl, Alexander, et al. ["Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans."](#) *Biochemical and Biophysical Research Communications*, vol. 459, no. 4, 2015, pp. 585-90.

- [“5G wireless telecommunications expansion: Public health and environmental implications,”](#) is a research review published in Environmental Research, which documents the range of adverse effects reported in the published literature from cancer to bacteria growth changes to DNA damage and concludes that “a moratorium on the deployment of 5G is warranted” and “the addition of this added high-frequency 5G radiation to an already complex mix of lower frequencies, will contribute to a negative public health outcome both from both physical and mental health perspectives.”³⁹
- A [study published in Electromagnetic Biology and Medicine](#), “Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base station,” compared people living close and far from a cell antennas and found that people living closer to cellular antennas had higher radiation levels in the homes and several significant changes in their blood predictive of cancer development.”⁴⁰
- A 2019 [study](#) of students in schools near cell towers found their higher RF exposure was associated with impacts on motor skills, memory and attention ([Meo 2019](#)).⁴¹ Examples of other effects linked to cell towers in research studies include [neuropsychiatric problems](#)⁴², [elevated diabetes](#)⁴³, [headaches](#)⁴⁴, [sleep problems](#)⁴⁵ and [genetic damage](#)⁴⁶. Such research continues to accumulate after the 2010 landmark [review study](#) on 56 studies that reported biological effects found at very low intensities, including impacts on reproduction, permeability of the blood-brain barrier, behavior, cellular and metabolic changes, and increases in cancer risk ([Lai and Levitt 2010](#)).⁴⁷
- Published research has found impacts from wireless radiation exposure to [reproduction](#) and [brain development](#) in addition to a myriad of other adverse effects.^{48,49,50,51} Although renowned institutions, such

³⁸ Tillmann, Thomas, et al. "[Indication of cocarcinogenic potential of chronic UMTS-modulated radiofrequency exposure in an ethylnitrosourea mouse model.](#)" *International Journal of Radiation Biology*, vol. 86, no. 7, 2010, pp. 529-41.

³⁹ <https://doi.org/10.1016/j.envres.2018.01.016>

⁴⁰ Zothansiana & Zosangzuali, Mary & Lalramdinpuui, Miriam & Jagetia, Ganesh & Siama, Zothan. (2017). [Impact of radiofrequency radiation on DNA damage and antioxidants in peripheral blood lymphocytes of humans residing in the vicinity of mobile phone base stations.](#) *Electromagnetic Biology and Medicine*. 36. 1-11. 10.1080/15368378.2017.1350584.

⁴¹ Meo, S. A., Almahmoud, M., Alsultan, Q., Alotaibi, N., Alnajashi, I., & Hajjar, W. M. (2019). [Mobile Phone Base Station Tower Settings Adjacent to School Buildings: Impact on Students' Cognitive Health.](#) *American Journal of Men's Health*. doi.org/10.1177/1557988318816914.

⁴² G. Abdel-Rassoul, O. Abou El-Fateh, M. Abou Salem, A. Michael, F. Farahat, M. El-Batanouny, E. Salem, [Neurobehavioral effects among inhabitants around mobile phone base stations](#), *NeuroToxicology*, Volume 28, Issue 2, 2007, Pages 434-440, ISSN 0161-813X, doi.org/10.1016/j.neuro.2006.07.012.

⁴³ SA, Meo & Alsubaie, Yazeed & Almubarak, Zaid & Almutawa, Hisham & AlQasem, Yazeed & Hasanato, Rana. (2015). [Association of Exposure to Radio-Frequency Electromagnetic Field Radiation \(RF-EMFR\) Generated by Mobile Phone Base Stations with Glycated Hemoglobin \(HbA1c\) and Risk of Type 2 Diabetes Mellitus.](#) *International Journal of Environmental Research and Public Health*. 12. 14519-14528;. 10.3390/ijerph121114519.

⁴⁴ Hutter, H. P., Moshammer, H., Wallner, P., & Kundi, M. (2006). [Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations.](#) *Occupational and environmental medicine*, 63(5), 307–313. doi:10.1136/oem.2005.020784.

⁴⁵ R. Santini, P. Santini, J.M. Danze, P. Le Ruz, M. Seigne, [Enquête sur la santé de riverains de stations relais de téléphonie mobile: I/Incidences de la distance et du sexe](#), *Pathologie Biologie*, Volume 50, Issue 6, 2002, Pages 369-373, ISSN 0369-8114, doi.org/10.1016/S0369-8114(02)00311-5.

⁴⁶ Gursatej Gandhi, Gurpreet Kaur & Uzma Nisar (2015) [A cross-sectional case control study on genetic damage in individuals residing in the vicinity of a mobile phone base station](#), *Electromagnetic Biology and Medicine*, 34:4,344-354, DOI: 10.3109/15368378.2014.933349.

⁴⁷ B. Blake Levitt and Henry Lai, [Biological effects from exposure to electromagnetic radiation emitted by cell tower base stations and other antenna arrays](#), *Environ. Rev.* Downloaded from www.nrcresearchpress.com by 172.58.41.200 on 04/10/19

⁴⁸ Adams, Jessica A., et al. "[Effect of mobile telephones on sperm quality: a systematic review and meta-analysis.](#)" *Environment International*, 70, 2014, pp. 106-112.

as the [Cleveland Clinic](#), advise men to keep phones and wireless devices away from their reproductive organs, the public remains largely unaware.

Once the towers are erected they will be upgraded over time with new antennas and soon 5G technology. 5G would use today's wireless frequencies while adding new, higher frequencies to transmit data at faster speeds. These higher frequency millimeter waves uniquely penetrate the eyes and skin,^{52,20,21,22} and have been shown to accelerate bacterial and viral cell growth.⁵³ Millimeter waves were originally developed as a military weapon to create the sensation that the skin is burning.⁵⁴ Currently accepted standards are not sophisticated enough to measure effects on sweat glands or quantify the risks of cumulative exposure.^{55,56} Any future applications of these technologies must consider the biological effect of cumulative exposures to these frequencies.

Radiofrequency radiation exposure is increasing at a rapid pace.

A [2018 article](#) published in *The Lancet Planetary Health* points to unprecedented increasing RF exposures, and the abstract concludes, "due to the exponential increase in the use of wireless personal communication devices (eg, mobile or cordless phones and WiFi or Bluetooth-enabled devices) and the infrastructure facilitating them, levels of exposure to radiofrequency electromagnetic radiation around the 1 GHz frequency band, which is mostly used for modern wireless communications, have increased from extremely low natural levels by about 1018 times..."([Bandara and Carpenter 2018](#)).⁵⁷

Another key finding from [Zothansiyama 2017](#) was that homes closer to antennas had measurably higher radiation levels—adding to the documentation that antennas increase RF levels. An [Australian study](#) also found that children in kindergartens with nearby antenna installations had nearly three-and-a-half times higher RF exposures than children with installations further away (more than 300 meters ([Bhatt 2016](#))).⁵⁸

⁴⁹ Deshmukh, P.S., et al. "[Cognitive impairment and neurogenotoxic effects in rats exposed to low-intensity microwave radiation.](#)" *International Journal of Toxicology*, vol. 34, no. 3, 2015, pp. 284-90.

⁵⁰ Aldad, T.S., et al. "[Fetal Radiofrequency Radiation Exposure From 800-1900 MHz-Rated Cellular Telephones Affects Neurodevelopment and Behavior in Mice.](#)" *Scientific Reports*, vol. 2, no. 312, 2012.

⁵¹ Sonmez, O.F., et al. "[Purkinje cell number decreases in the adult female rat cerebellum following exposure to 900 MHz electromagnetic field.](#)" *Brain Research*, vol. 1356, 2010, pp. 95-101.

⁵² A [lecture](#) by Paul Ben-Ishai, PhD at the Israel Institute for Advanced Studies on this finding can be found on the [2017 IIAS Conference website](#). Feldman, Yuri and Paul Ben-Ishai. "[Potential Risks to Human Health Originating from Future Sub-MM Communication Systems.](#)" *Conference on Wireless and Health*, 2017.

⁵³ Cindy L. Russell, [5G Wireless Telecommunications Expansion: Public Health and Environmental Implications](#), 165 *Env't Res.* 484 (2018).

⁵⁴ For information on Active Denial Systems, see, e.g., [Vehicle-Mounted Active Denial System \(V-MADS\)](#) ; [Active Denial System FAQs](#).

⁵⁵ A [lecture](#) by Paul Ben-Ishai, PhD at the Israel Institute for Advanced Studies on this finding can be found on the [2017 IIAS Conference website](#). Feldman, Yuri and Paul Ben-Ishai. "[Potential Risks to Human Health Originating from Future Sub-MM Communication Systems.](#)" *Conference on Wireless and Health*, 2017.

⁵⁶ Hayut, Itai, Paul Ben Ishai, Aharon J. Agranat and Yuri Feldman. "[Circular polarization induced by the three-dimensional chiral structure of human sweat ducts.](#)" *Physical Review E*, vol. 89, no. 042715, 2014.

⁵⁷ Priyanka Bandara, David O Carpenter, [Planetary electromagnetic pollution: it is time to assess its impact](#), *The Lancet Planetary Health*, Volume 2, Issue 12, 2018, Pages e512-e514, ISSN 2542-5196, doi.org/10.1016/S2542-5196(18)30221-3.

⁵⁸ Bhatt, C. R., Redmayne, M., Billah, B., Abramson, M. J., & Benke, G. (2016). [Radiofrequency-electromagnetic field exposures in kindergarten children](#). *Journal Of Exposure Science And Environmental Epidemiology*, 27, 497. Retrieved from <https://doi.org/10.1038/jes.2016.55>.

A 2018 multi-country [study](#) that measured RF in several countries found that cell phone tower radiation is the dominant contributor to RF exposure in most outdoor areas exposure in urban areas was higher and that exposure has drastically increased. As an example, the measurements the researchers [took](#) in Los Angeles, USA was 70 times higher than the US EPA estimate 40 years ago.⁵⁹

FCC limits are non-protective

FCC limits are based only on thermal heating and do not account for biological impacts at levels far lower than FCC limits. The Department of Interior wrote a [2014 letter](#) on the impact of cell towers on migratory birds documenting several studies that found adverse effects and concludes that “The electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today.”⁶⁰

In the United States, RFR radiation regulatory limits were set by the FCC more than two decades ago in 1996. However, the FCC limits are not safety standards. Although the EPA was actively researching this issue and tasked to develop proper safety limits,^{61,62} the EPA was abruptly defunded in 1996 and the FCC adopted guidelines developed by industry-connected non-independent groups ([ANSI/IEEE C95.1-1992](#), [NCRP’s 1986 Report](#))⁶³ Experts from U.S. government agencies (including the EPA and NIOSH) have repeatedly documented issues concerning the inadequacy of these limits but their letters have gone unanswered.^{64,65} The EPA has clarified that the FCC limits do not protect against effects from long-term low-level exposures.⁶⁶ In 2008, the National Academy of Sciences released a [Report](#) on research needs that included recommending research on the impacts to brain development and exposures to children and pregnant women.⁶⁷

In 2012, the Government Accountability Office issued a [Report](#) calling for RFR standards to be updated with current research recommending that the FCC formally reassess the current RF energy exposure limit, including its effects on

⁵⁹ Sanjay Sagar, Seid M. Adem, Benjamin Struchen, Sarah P. Loughran, Michael E. Brunjes, Lisa Arangua, Mohamed Aqiel Dalvie, Rodney J. Croft, Michael Jerrett, Joel M. Moskowitz, Tony Kuo, Martin Rössli, [Comparison of radiofrequency electromagnetic field exposure levels in different everyday microenvironments in an international context](#), Environment International, Volume 114, 2018, Pages 297-306, ISSN 0160-4120, doi.org/10.1016/j.envint.2018.02.036.

⁶⁰ W.R. Taylor, February 7, 2014, United States Department of the Interior, [Letter In Reply Refer To: \(ER 14/0001\) \(ER 14/0004\)](#).

⁶¹ A [lecture](#) by Paul Ben-Ishai, PhD at the Israel Institute for Advanced Studies on this finding can be found on the [2017 IIAS Conference website](#). Feldman, Yuri and Paul Ben-Ishai. “[Potential Risks to Human Health Originating from Future Sub-MM Communication Systems.](#)” *Conference on Wireless and Health*, 2017.

⁶² Hayut, Itai, Paul Ben Ishai, Aharon J. Agranat and Yuri Feldman. “[Circular polarization induced by the three-dimensional chiral structure of human sweat ducts.](#)” *Physical Review E*, vol. 89, no. 042715, 2014.

⁶³ <https://www.fcc.gov/general/fcc-policy-human-exposure#block-menu-block-4>

⁶⁴ A [lecture](#) by Paul Ben-Ishai, PhD at the Israel Institute for Advanced Studies on this finding can be found on the [2017 IIAS Conference website](#). Feldman, Yuri and Paul Ben-Ishai. “[Potential Risks to Human Health Originating from Future Sub-MM Communication Systems.](#)” *Conference on Wireless and Health*, 2017.

⁶⁵ Hayut, Itai, Paul Ben Ishai, Aharon J. Agranat and Yuri Feldman. “[Circular polarization induced by the three-dimensional chiral structure of human sweat ducts.](#)” *Physical Review E*, vol. 89, no. 042715, 2014.

⁶⁶ <https://ehtrust.org/wp-content/uploads/4c0f61dc30c3d6bb27d90f53a57c616e.pdf>

⁶⁷ Consensus Study Report, [Identification of Research Needs Relating to Potential Biological or Adverse Health Effects of Wireless Communication Devices](#), 2008.

human health, the costs, and benefits associated with keeping the current limit, and the opinions of relevant health and safety agencies, and change the limit if determined appropriate. In response to the [2012 GAO Report](#), the FCC opened proceedings ([ET Docket No. 13-84 Reassessment of FCC Radiofrequency Exposure Limits](#) and [ET Docket No. 03-137 Proposed Changes in the Commission’s Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields](#)) to explore whether it should modify its radiofrequency exposure standards. The [FCC also noted](#), “we specifically seek comment as to whether our current limits are appropriate as they relate to device use by children.” To date, the FCC has failed to act. Over 900 comments have been filed since the FCC opened these dockets these dockets, but no US health agency has submitted any opinion or scientific documentation to either docket.

Due to the FCC’s inaction, the GAO has [updated](#) the status⁶⁸ as “Closed - Not Implemented” with these comments: “despite many years of consideration, FCC still has no specific plans to take any actions that would satisfy our recommendations. Accordingly, we are closing the recommendations as not implemented.”

Children are more vulnerable.

Children’s skulls are thinner, their heads are smaller, and the radiation penetrates deeper into their brain. Research has found that a child’s head’s absorption can be over two times greater, and absorption of the skull’s bone marrow can be ten times greater, than adults.^{69,70} The American Academy of Pediatrics, which is the largest organization of U.S. pediatricians, has repeatedly [written](#) to the U.S. government documenting children’s vulnerabilities and recommends reducing children’s and pregnant women’s exposure.⁷¹

The [California Department of Health](#), the [Connecticut Department of Health](#), many international health [organizations](#) and medical associations, and more than 20 [governments](#) are recommending wireless exposure reduction, especially for children.⁷²

Several countries have allowable public exposure limits lower than ICNIRP levels with limits that are even more protective for kindergartens, schools and hospitals. In addition, some governments’ regulatory actions include banning cell phones or removing Wi-Fi and cell towers in or near schools.⁷³ For example:

- Belgium and France have banned the sale of cell phones designed for young children and made it illegal to market cell phones to children less than 14 years of age.

⁶⁸ [Exposure and Testing Requirements for Mobile Phones Should Be Reassessed GAO-12-771](#): Published: Jul 24, 2012. Publicly Released: Aug 7, 2012.

⁶⁹ A [lecture](#) by Paul Ben-Ishai, PhD at the Israel Institute for Advanced Studies on this finding can be found on the [2017 IIAS Conference website](#). Feldman, Yuri and Paul Ben-Ishai. “[Potential Risks to Human Health Originating from Future Sub-MM Communication Systems](#).” *Conference on Wireless and Health*, 2017.

⁷⁰ Hayut, Itai, Paul Ben Ishai, Aharon J. Agranat and Yuri Feldman. “[Circular polarization induced by the three-dimensional chiral structure of human sweat ducts](#).” *Physical Review E*, vol. 89, no. 042715, 2014.

⁷¹ <https://ehtrust.org/wp-content/uploads/American-Academy-of-Pediatrics-Letters-pdf>

⁷² For more on international policy actions, see our [online briefing](#). “[International Policy Briefing: Cautionary Policy on Radiofrequency Radiation Actions by Governments, Health Authorities and Schools Worldwide](#).” Environmental Health Trust, 2017.

⁷³ See [Database of Worldwide Policies on Cell Phones, Wireless and Health](#), Environmental Health Trust.

- France has banned cell phones in elementary and middle schools, and playgrounds.⁷⁴
- The Supreme Court of India upheld the High Court of the State of Rajasthan’s decision to remove all cell towers from the vicinity of schools, hospitals and playgrounds because this radiation is “hazardous” and causes cancer, brain tumour, digestive disorder and tachycardia.⁷⁵
- The Environment Minister of Italy has decreed to reduce as much as possible indoor exposure to both ELF-EMF and RF-EMF.
- Cyprus has banned Wi-Fi from kindergartens and elementary classrooms.
- In Chile, the 2012 “[Antenna Law](#)” prohibits cell antennas/towers in “sensitive areas” such as “educational institutions, nurseries, kindergartens, hospitals, clinics, nursing homes or other institutions of similar nature.”⁷⁶

Children will have a lifetime of exposure to wireless radiation; in order to protect their healthy future, public health authorities must limit this exposure as much as possible.

Moreover, [recent cell phone radiation tests](#) released by the French government found that nine out of ten cell phones exceed regulatory limits for radiofrequency radiation when tested in body contact positions (simulating a phone in pants pocket, bra or resting on chest). Despite this documentation, U.S. radiation limits have still not been revised. To this date, there has been no public record of an independent systematic review of the research by any U.S. health agency in order to set proper safety standards. The current outdated regulations are inadequate to protect public health.

Since 1997, insurance companies have refused to insure wireless companies and “[electromagnetic field exclusions](#)” in insurance policies are an industry standard. EMFs are deemed as “high-risk” in insurance [white papers](#), and EMFs are [defined](#) as a “pollutant” by many insurance companies alongside smoke, chemicals, and asbestos. Some companies will only cover liability from EMFs under additional “[Pollution Liability](#)” policy enhancement coverage. Some policies not only exclude damages from EMFs but also exclude paying for the defense of “*any supervision, instruction, recommendation, warning or advice given or which should have been given in connection with bodily injury, property damage, abatement and/or mitigation etc.*”

Wireless companies [warn](#) their shareholders—in mandated annual [10k filings](#)—that they may incur financial losses from lawsuits related to EMF radiation emissions of their products. For example:

- AT&T [states](#), “*We may incur significant expenses defending such suits or government charges and may be required to pay amounts or otherwise change our operations in ways that could materially adversely affect our operations or financial results.*”
- Crown Castle’s [2016 10-K ANNUAL REPORT](#) states, “*If radio frequency emissions from wireless handsets or equipment on our wireless infrastructure are demonstrated to cause negative health effects, potential future claims could adversely affect our operations, costs or revenues. The potential connection between radio frequency emissions and certain negative health effects, including some forms of cancer, has*

⁷⁴ « [Plus de téléphones portables dans les écoles et collèges à la rentrée 2018](#) », [annonce Jean-Michel Blanquer](#), Le Monde (Dec. 10, 2017).

⁷⁵ Abhinav Sharma, [Rajasthan HC orders relocation of mobile towers from schools, hospitals](#), Economic Times (Nov. 28, 2012).

⁷⁶ [New communications antenna law in Chile](#), 20 Communications Law: Newsletter of the International Bar Association Legal Practice Division 14-16 (2013).

been the subject of substantial study by the scientific community in recent years. We cannot guarantee that claims relating to radio frequency emissions will not arise in the future or that the results of such studies will not be adverse to us...If a connection between radio frequency emissions and possible negative health effects were established, our operations, costs, or revenues may be materially and adversely affected. We currently do not maintain any significant insurance with respect to these matters.”

Most wireless companies—from [AT&T](#) to [Nokia](#) to [T Mobile](#) to [Verizon Wireless](#)—have issued [similar warnings](#) to their shareholders.⁷⁷

Will the visiting public to the National Parks also be warned of the risk?

Scientists Worldwide: Reduce Exposure

An increasing number of [experts](#) around the world are calling for reduced exposure—due to the unprecedented threat to public health and the environment—to stop the installation of radiation-emitting equipment placed within meters of homes, playgrounds, and schools.

- In 2015, the [International EMF Scientist Appeal](#), now signed by over 225 scientists from 41 nations, urging the development of more protective guidelines for EMF (including RF-EMF), encouraging precautionary measures, and calling for education of the public about health risks, particularly risks to children and fetal development, was submitted to the Secretary-General of the United Nations, the Director-General of the World Health Organization, and U.N. Member Nations.⁷⁸
- In June 2017, EMF Scientists submitted [Comments to the U.S. FCC](#), asking the FCC to critically consider the potential impact of the 5th generation wireless infrastructure on the health and safety of the U.S. population before proceeding to deploy this infrastructure.
- In September 2017, I joined over 180 experts from 35 countries who sent a [declaration](#) to the European Union calling for a moratorium on 5G until hazards have been fully investigated by independent scientists, citing potential neurological impacts, infertility, and cancer.⁷⁹

The tobacco and asbestos crises demonstrate that failing to act on public health hazards when they arise can lead to irreversible damage later. EHT thus strongly opposes building out 5G infrastructure—which would place thousands of new sources of microwave radiation emissions in close proximity to workers, families, and local wildlife—at least until more testing has been conducted.

Cell Towers Create Additional Safety Hazards

Another area of concern with the proposed expansion of the wireless infrastructure is fires. Cell towers are known to catch fire such as the [150-foot tower in Washington](#) that experienced an electrical malfunction at a lighted beacon on top of the tower which caught an Osprey’s nest on fire. Many birds, particularly raptors, choose to nest on or near cell towers because of the heat they provide, the clear view, and high vantage point that they favor for their nesting

⁷⁷ [Corporate Company Investor Warnings In Annual Reports 10k Filings Cell Phone Radiation Risks](#)

⁷⁸ Blank, M., et al. "[International Appeal: Scientists call for protection from non-ionizing electromagnetic field exposure.](#)" *European Journal of Oncology*, vol. 20, no. 3/4, 2015, pp. 180-2.

⁷⁹ "[Appeal to the European Union: Scientists warn of potential serious health effects of 5G.](#)" 13 September 2017.

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sites. There are many more examples of these towers catching fire, such as a [125-foot tower in Maryland](#). A church in South Africa that housed antennas caught fire this month, and [news reports](#) state authorities are investigating if it was a short circuit from the equipment that started the fire.

Towers have also been known to attract [lightning strikes](#). The higher the tower the higher the probability that lightning will strike the tower, presenting another type of fire hazard.⁸⁰

We at the Environmental Health Trust urge you, as stewards of our national parks and along with [your mission](#), “The **National Park Service** preserves unimpaired the **natural** and cultural resources and values of the **national park** system for the enjoyment, education, and inspiration of this and future generations,” to seek out the research and information about the health effects on both humans and the flora and fauna of the parks in order to protect and preserve. Taking all information into consideration you are also following [the National Park Service's own statement](#), “by caring for the parks and conveying the park ethic, we care for ourselves and act on behalf of the future. The larger purpose of this mission is to build a citizenry that is committed to conserving its heritage and its home on earth.”⁸¹

Respectfully submitted,

A handwritten signature in black ink that reads "Devra Davis".

Devra Davis, PhD, MPH
President, Environmental Health Trust
Fellow, American College of Epidemiology
Visiting Prof. Hebrew Univ. Hadassah Medical Center & Ondokuz Mayis Univ. Medical School
Associate Editor, *Frontiers in Radiation and Health*

⁸⁰ Witman, S. (2017), [Antenna towers attract additional lightning strikes](#), *Eos*, 98, doi.org/10.1029/2017EO074341. Published on 26 May 2017.

⁸¹ [NPS Entering the 21st Century](#), Changes in Mission, Changes in the Future, 2016.

April 21, 2021

Honorable Joseph R. Biden, President
The White House
1600 Pennsylvania Avenue N.W.
Washington, DC 20500

Dear President Biden,

We write to you as scientists deeply committed to protecting public health and the environment and as authors of several hundred publications, including some prepared for the Intergovernmental Panel on Climate Change. We are writing to urge you to take immediate actions to reduce and restrict the rapid and continuing increase in our schools, workplaces, and homes of a harmful environmental pollutant — wireless microwave radiofrequency radiation (RFR).

Children are [more vulnerable](#) to wireless radiation. They should not be doing homework on cell phones or with wireless hotspots that [catch fire](#). Wireless networks have numerous environmental impacts meriting concerted regulatory control.

We agree that “broadband internet is the new electricity” that enables Americans to do their jobs, to participate equally in school learning and health care, and to create a fairer playing field by eliminating the digital divide. The United States must bridge the digital divide with a “future proof” broadband infrastructure that is affordable, reliable, high-speed, and sustainable.

This infrastructure should be wired, not wireless. We urge that wherever possible the broadband system envisioned in the American Jobs Plan rely on safer, more secure and efficient, wired connections, especially for schools and other institutions where wired connections will save money and eliminate exposures to wireless radiation, found by the National Toxicology Program to cause clear evidence of cancer.

BIOLOGICAL AND ECOLOGICAL IMPACTS OF WIRELESS AND NON-IONIZING RADIATION

A substantial body of [peer-reviewed scientific reports](#) document multiple serious negative impacts on human health from wireless microwave radiation, including [increased brain](#), [breast](#) and [thyroid](#) cancer risk, [cellular stress](#), [genetic damage](#), harm to the [reproductive system](#), [learning](#) and [memory deficits](#), [behavioral problems](#), [neurological effects](#), [damage to brain development](#), [headaches](#), and various [impacts to wellbeing](#).

This letter takes the liberty of providing a detailed appendix with some of the growing and robust independent scientific literature linking wireless radiofrequency radiation to numerous health effects. The literature makes clear the need for a major change in our approach to wireless technology, especially as millions of families increasingly use video conferences for school and work.

Most notable among the science on RFR is the United States' own years-long [National Toxicology Program](#) (NTP) study into the effects of cellphone radiation exposure. The \$30 million, interagency-supported study originally requested and commissioned by the Food and Drug Administration (FDA) exposed animals in their lifetimes to the same levels of cell phone radiation that humans get today. Using standard protocols for testing, the NTP study showed conclusively that low-intensity, modulated radio signals of the form of GSM and CDMA cause cancer and heart damage in animals as well as DNA damage in multiple organs.

Non-ionizing radiation at lower frequencies also can cause biological harm to humans, studies show. As an example, Kaiser Permanente research on prenatal exposures to magnetic field non-ionizing electromagnetic field (EMF) radiation has found increased [miscarriage](#) as well as higher incidences of [ADHD](#), [obesity](#), and [asthma](#). While several countries have strict limits on residential exposures, the United States has no regulatory limits whatsoever on allowable exposures to magnetic field non-ionizing EMF.

Recent reports from the [Swiss government's](#) EMF expert advisory group, the [National Research Foundation of Korea](#), and [Yale Medicine](#), confirm the view that *legal levels* of wireless radiation can damage the health of children, pregnant women, and the medically vulnerable.

Christopher Portier PhD, a longtime U.S. government scientist now retired, recently submitted a [comprehensive review](#) of the scientific research in a major cell phone/brain cancer lawsuit where he concludes that “the evidence on an association between cellular phone use and the risk of glioma in adults is quite strong.”

“In my opinion, RF exposure probably causes gliomas and neuromas and, given the human, animal and experimental evidence, I assert that, to a reasonable degree of scientific certainty, the probability that RF exposure causes gliomas and neuromas is high,” he wrote.

The [176-page expert report](#) with 443 references was prepared for the plaintiffs in a major product liability [lawsuit](#), Murray et al. v Motorola, Inc. et al., filed in the Superior Court for the District of Columbia against the telecommunications industry. Dr. Portier was the Director of the United States National Center for Environmental Health at the Centers for Disease Control and Prevention in Atlanta, and the Director of the Agency for Toxic Substances and Disease Registry. He is one of many US governments scientists and [advisors to the World Health Organization](#) highlighting the ever-growing body of scientific evidence showing harm.

THE ENVIRONMENTAL IMPERATIVE

The unfettered proliferation of new wireless networks including 5G and 4G antenna densification constitutes a major global contributor to greenhouse gases and hazardous e-waste. Rather than advance climate objectives, 5G instead constitutes an unmitigated disaster for our climate because of the vast surge in energy demand that will take place. Further, 5G deployment will increase environmental levels of RFR, which science documents to be harmful not only to human health, but also to wildlife and the environment.

5G requires hundreds of thousands of new so-called “small” cell towers and billions of new wireless devices, which will use massive amounts of energy in their production, operation, and disposal. 5G antennas are referred to as “[hungry, hungry hippos](#)” and “[a battery vampire](#).” [Numerous reports](#) have [documented](#) the exponentially increased use of energy by 5G and 4G densification and the Internet of Things. [Streaming](#) with [wireless](#) results in higher greenhouse gas emissions compared to safer, faster, and more secure corded/wired fiber-optic connections.

While there may be improvements in energy efficiency for new devices individually, these gains are completely lost in the increases in total demand that will take place with the proliferation of games, videos, other streaming services, and the continued generation of highly addictive apps.

Additionally, telecommunications firms contend that 5G network antennas must be sited about every 100 yards, and they have haphazardly started nationwide construction on hundreds of thousands of new “small cell” antennas near our homes and schools.

5G densification to accommodate this wireless infrastructure will inevitably require the removal of countless numbers of trees from urban and rural locales. Not only will this destroy valuable tree canopies, increase greenhouse gases, and damage root systems, but it will cause a dramatic increase in environmental levels of radiofrequency radiation (RFR) known to [damage trees](#). Wireless technology can also impact [insects](#), [bees](#), [plants](#), [animals](#), and [bacteria](#), all of which are vital to the ecosystem, even in the densest urban environment.

U.S. FEDERAL POLICY ON 5G DISREGARDS HEALTH AND ENVIRONMENTAL IMPACTS

The implication of the NTP study, and a [parallel study](#) carried out by the Ramazzini Institute of Bologna, Italy, along with recent reviews on [oxidative stress](#), reproduction and [genetic effects](#), is that current Federal Communications Commission (FCC) human exposure limits for non-ionizing RFR originating from the wireless infrastructure allow for hazardous levels of exposure. In reality, the push for 5G constitutes an unethical experiment with all of us as unwitting subjects.

The FCC has [proposed new rules](#) for a large range of EMF frequencies (lower than are currently used for wireless networks) without adequate safety testing. As scientific comments in FCC [Docket 19-226](#) document, these lower frequencies cannot be considered safe.

It is not widely appreciated that the FCC already ushered in unprecedented and untested commercial expansion of 5G and 4G cellular technology without serious deliberation on the effects of this new technology on humans and the environment. Its lack of serious, systematic deliberation on the science is demonstrated by its unchecked rejection of the need to comply with the National Environmental Policy Act (NEPA), the Administrative Procedures Act (APA), and the Americans With Disabilities Act (ADA).

Our historic legal appeal, [EHT et al. v. FCC](#), documents numerous violations of these federal laws and demonstrates how the FCC did not provide evidence of having undergone a “hard-look” or systematic assessment of the scientific evidence on the [FCC's own record](#) when [deciding in 2019](#) to keep its outdated 1996 wireless radiation limits.

Under NEPA, all major federal regulations must undergo review for their potential impact on the environment. FCC limits are not designed to protect wildlife or the natural environment, yet the FCC refused to conduct an environmental assessment of the 5G network. Although the records were withheld, FOIA investigations by the Environmental Health Trust have found that the FCC [internally discussed](#) the issue of environmental review related to 5G, yet never moved forward to complete one. Studies attached in our appendix show the folly of this unscientific decision.

Unlike other countries that provide robust resources to their people on how to decrease exposure, United States agencies downplay the issue of health effects and provide minimal information on how families can reduce exposures. The Centers for Disease Control (CDC) [hired an industry consultant](#) to draft numerous website pages on the health effects of non-ionizing radiation. The [EPA](#) scrubbed their website of content on potential health risks of wireless radiation.

Further, the FCC and FDA now state that they rely on a self-appointed, self-monitored, private club, to which no American belongs, termed the International Commission of Non-ionizing Radiation Protection (ICNIRP). This small group of around one dozen scientists is closely allied with industry and does not represent the larger expert scientific community. It repeatedly puts forward [unfounded criticisms](#) of U.S. government research yet remains unchecked by oversight or independent external review. [Numerous investigations](#), [published research](#), and a [2020 report](#) released by European Members of Parliament details the ways in which ICNIRP has serious conflicts of interests and remains under the influence of the telecommunications industry. Yet both the FCC and the FDA substantiate their rejection of the US NTP \$30 million animal study with ICNIRP's criticism despite the fact that several retired [scientists](#) of the National Institutes of Health have documented that ICNIRP's criticisms are erroneous.

As a result of the FCC's omissions, the 5G rollout and 4G densification must be halted until environmental evaluations are completed and federally developed safety limits that protect public health and the environment are created.

POLICY RECOMMENDATIONS

As scientists dedicated to public health, we ask that the broadband infrastructure cited in the American Jobs Plan prioritize a wired telecommunication infrastructure, and that the climate, public health, and environmental impacts of future networks be integrated into any assessment of policy options and proposed regulations promulgated by your administration.

We recommend the following:

1. **A sustainable wired (not wireless) infrastructure: The administration should focus on infrastructure that includes wired networks *up to* and *inside* of buildings and evaluate economic opportunities to ensure environmentally sustainable infrastructure.** In anticipating thousands of miles of new transmission lines to be laid to renew the electrical grid, we stress that much-needed expanded access to broadband need not and should not depend on wireless networks but instead on economical wired fiber-optic cable that goes to and through the premises.
2. **An immediate halt to the 5G rollout and associated 4G densification.** Consistent with concerns expressed by a number of environmental organizations in this nation and expert advice from experts in other nations, we call for a full halt to the more than 1 million new 5G network antennas and associated cell towers — some slated for neighborhoods and areas of pristine wilderness [in our National Parks](#) — and the concomitant destruction of hundreds of thousands of trees and wildlife habitats.
3. **An assessment of the energy consumption and climate impact of 5G and 4G densification.** We urge you to include a full life-cycle assessment of the potential impact of wireless antenna densification on climate policy that takes into account growing evidence of substantially increased greenhouse gas emissions if 5G were to be implemented, as well as emissions and pollution analysis related to the extraction, production, transportation, and disposal of materials in the full life cycle of wireless technologies.
4. **An assessment of the environmental impact of the 5G network.** The U.S. must first do a comprehensive assessment on the environmental impacts of the hundreds of thousands of new 5G/4G wireless facilities which includes impacts to tree canopy, wildlife habitat, and how millimeter waves will impact insects and pollinators and more.
5. **A genuine review of the entire body of scientific research on non-ionizing electromagnetic radiation on human and environmental health.** Independent experts and relevant government authorities must conduct a review of the full body of scientific research so that they may develop biologically based federal safety limits for human and wildlife exposures to radiofrequency and magnetic field non-ionizing electromagnetic

radiation. The review must engage all relevant U.S. health, science, and environmental agencies (such as the Environmental Protection Agency (EPA), National Cancer Institute (NCI), Occupational Safety and Health Administration (OSHA), the National Institutes of Health (NIH) and National Toxicology Program (NTP)) and take into account the ever-growing scientific evidence of immediate and long-term biological impacts as well as the rapidly expanding impacts on climate, wildlife, and our natural world.

6. **The development of science-based safety limits for human and wildlife exposures to RFR and non ionizing EMF.** The allowable exposure limits for RFR were adopted in 1996 and have not changed since then. The EPA should develop safety limits based on scientific research. The United States must also develop exposure limits on magnetic field EMF and other frequencies in the non-ionizing range used in electricity distribution, wireless power transfer and other applications.
7. **Appointment of FCC commissioners who are absent of ties to the wireless Industry.** We call on you to end [the revolving door](#) through which FCC commissioners come from and return to the telecom industry. The FCC is termed a “Captured Agency” in a Safra Center for Ethics, Harvard Law School report. We ask you to ban all telecom industry executives, lobbyists, and representatives from any advisory or official position in your transition team, cabinet, and administration.
8. **Appointment of an interdisciplinary committee at the National Academies of Sciences (NAS) to review the science underlying 5G and wireless networks, to identify major data gaps and uncertainties, and to set priorities for research on health and safety.** This review must systematically consider the full lifetime costs and benefits of 5G and other telecom technologies now on the drawing board and evaluate immediate and long-term climate impacts. The National Academy of Sciences (NAS) Report [“An Assessment of Illness in U.S. Government Employees and Their Families at Overseas Embassies”](#) commissioned by the U.S. State Department cites “directed, pulsed radiofrequency energy” as “the most plausible mechanism” to explain the mystery illness suffered by U.S. Embassy personnel. The NAS must also develop a major interdisciplinary training program for medical and engineering professionals to better understand the impacts of bioelectromagnetics.
9. **A multimedia national public awareness education campaign so that people know why and how to reduce exposure to wireless and other non-ionizing electromagnetic radiation.** We also ask that your administration develop and validate a nationwide educational campaign for parents, teachers, and the public so they understand why and how to reduce daily exposures to wireless radiofrequency and other non-ionizing radiation from laptops, cell phones, and the numerous digital devices in our lives today. This includes an update to the public information posted on the websites of the CDC, EPA, National Cancer Institute, and FCC to include straightforward, unambiguous recommendations to reduce exposure to non-ionizing radiation as well as refer to the full results of the National Toxicology Program study and other independent research on wireless and non-ionizing radiation.

10. **Promotion of policies that reduce wireless exposures in schools.** Strategies are urgently needed to eliminate sources of radiofrequency radiation in the indoor environment, especially in schools and public buildings. Wi-Fi infrastructure should be replaced with wired networks in the classroom where children spent most of their waking hours.
11. **Labor policy that addresses growing occupational exposures.** An investigation by the National Department of Labor and Occupational Safety and Health Administration into current and projected occupational exposures and practical measures to reduce occupational exposures is urgently needed addressing the range of workplace exposure from hospitals, to schools, to delivery drivers, to electricians working on rooftops, to cell tower climbers.
12. **The launch of a task force convened by the Surgeon General on how to minimize health effects of technology on children.** The harmful physical, social, and emotional effects of screens is well documented yet our children's use of screens is ever increasing.

INTERNATIONAL ACTIONS ON WIRELESS INFRASTRUCTURE

While the U.S. should be leading efforts to create and validate safer technology, especially for our schools and workforce, we have fallen far behind other countries in this regard. It is time for change.

Several high-tech nations have surpassed the United States in recognizing not only environmental but also human impacts from wireless radiation exposure. France, Israel, Korea, French Polynesia, and Switzerland, among others, have policies and educational programs to reduce public exposure to wireless and non-ionizing radiation. Numerous countries have far more stringent cell tower radiation exposure limits compared to the United States.

Deeply concerned about growing evidence linking brain cancer to cell phone use, the Korean National Cancer Institute has issued clear recommendations to reduce cell phone radiation to children. Other nations issue notices at points of sale, ban or restrict the use of Wi-Fi and cell phones in schools, and ban the advertising and sale of cell phones to young children.

In economic terms, the American Jobs Plan notes that the United States "has some of the highest broadband prices among OECD countries." Current proposals for wireless 5G are far more costly and wasteful than wired communications. Wired cables create a safer, more secure, faster, and longer-lasting connection. In sum, they are more cost-effective.

Our experts stand ready to provide more detailed information to you on this important issue, including elaborating on materials in the attached appendix and assistance with evaluating the science and impacts on humans, climate, animals, and wilderness.

Yours sincerely,



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The Honorable John Kerry, Special Presidential Envoy for Climate
Mr. Shawn Benghe, Acting Director of the U.S. National Park Service
The Honorable Nancy Pelosi, CA-12
The Honorable Conor Lamb, PA-17
The Honorable Susie Lee, NV-03
The Honorable Chrissy Houlahan, PA-06
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APPENDIX

Reports and White Papers: 5G, Energy Consumption, and Climate

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Letter from the EPA to Environmental Health Trust

----- Forwarded message -----

From: **Veal, Lee**<Veal.Lee@epa.gov>

Date: Wed, Jul 8, 2020 at 11:32 AM

Subject: RE: Letter with specific Questions Related to the FDA review and to the EPA, CDC, NIOSH and FDA Jurisdiction on EMFs

To: Theodora Scarato <Theodora.Scarato@ehtrust.org>

Dear Director Scarato;

Thank you for sending us your questions and references regarding radiofrequency (RF) radiation. Up through the mid-1990s, EPA did study non-ionizing radiation. The Telecommunications Act of 1996 directs the Federal Communications Commission (FCC) to establish rules regarding RF exposure, while the U.S. Food and Drug Administration (FDA) sets standards for electronic devices that emit non-ionizing or ionizing radiation. EPA does not have a funded mandate for radiofrequency matters, nor do we have a dedicated subject matter expert in radiofrequency exposure. The EPA defers to other agencies possessing a defined role regarding RF. Although your questions are outside our current area of responsibilities, we have provided a response to each one as you requested.

1. *What is your response to these scientists' statements regarding the FDA report and the call to retract it?*

EPA Response: The EPA does not have a funded mandate for radiofrequency matters, has not

conducted a review of the FDA report you cited or the scientists' statements, and therefore has no response to it.

2. *To the FDA- What consultants were hired for the FDA review and report on cell phone radiation?*

EPA Response: This is not an EPA matter. Please refer this question to the FDA.

3. *What U.S. agency has reviewed the research on cell phone radiation and brain damage? I ask this because the FDA only has looked at selected studies on cancer. If your agency has not, please simply state you have not.*

EPA Response: EPA's last review was in the 1984 document [Biological Effects of Radiofrequency Radiation \(EPA 600/8-83-026F\)](#). The EPA does not currently have a funded mandate for radiofrequency matters.

4. *What U.S. agency has reviewed the research on damage to memory by cell phone radiation? If so, when and send a link to the review.*

EPA Response: EPA's last review was in the 1984 document [Biological Effects of Radiofrequency Radiation \(EPA 600/8-83-026F\)](#). The EPA does not currently have a funded mandate for radiofrequency matters.

5. *What U.S. agency has reviewed the research on damage to trees from cell phone radiation? If so, when was it issued and send a link to the review. [Note this study showing damage from long term exposure to cell antennas.](#)*

EPA Response: The EPA does not have a funded mandate for radiofrequency matters, and we are not aware of any EPA reviews that have been conducted on this topic. We do not know if any other U.S. agencies have reviewed it.

6. *What U.S. agency has reviewed the research on impacts to birds and bees? If so, when and send a link to the review. I will note the latest research showing [possible impacts to bees](#) from higher frequencies to be used in 5G.*

EPA Response: The EPA does not have a funded mandate for radiofrequency matters, and we are not aware of any EPA reviews that have been conducted on this topic. We do not know if any other US agencies have reviewed it.

2022

5G, 4G

CELL TOWER RADIATION

A REGULATORY GAP

WWW.EHTRUST.ORG

No Federal Agency With Health Expertise Is Ensuring Cell Tower Radiation Safety

There is no U.S. government accountability or oversight for cell tower radiation: no research reviews, no reports, no environmental monitoring, no risk mitigation and no post market health surveillance for the daily, full body radio-frequency (RF) radiation exposure from cell towers. The EPA was defunded in 1996 just as it was developing federal safety standards. U.S. cell tower radiation RF limits are far more permissive than the RF limits of China, Russia, Italy, India and numerous other countries.



"The FDA does not regulate cell towers or cell tower radiation. Therefore, the FDA has no studies or information on cell towers to provide in response to your questions."

-Ellen Flannery, Director, FDA Policy Center for Devices and Radiological Health to a California mother with a cell tower on her street who asked the FDA about safety, July 11, 2022



"As a Federal research agency, the NCI is not involved in the regulation of radio frequency telecommunications infrastructure and devices, nor do we make recommendations for policies related to this technology"

-National Cancer Institute letter to New Hampshire State Commissioner Denise Ricciardi, July 30, 2020



The ACS does "not have any official position or statement on whether or not radiofrequency radiation from cell phones, cell phones towers, or other sources is a cause of cancer."

-American Cancer Society Website



"EPA's last review was in the 1984 document Biological Effects of Radiofrequency Radiation. The EPA does not currently have a funded mandate for radiofrequency matters."

-Lee Ann B. Veal Director, EPA Radiation Protection Division Office of Radiation and Indoor Air, July 8, 2020 Letter to Theodora Scarato



Fact: There are no scientific reports by the CDC on cell tower radiation safety, nor does the agency have staff with expertise monitoring the science and evaluating risk. Public information requests found that **several CDC website pages on radio frequency were found to be drafted with a wireless industry consultant.**



"The electromagnetic radiation standards used by the Federal Communications Commission (FCC) continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today." - **U.S. Department of Interior Letter to FCC, 2014**



Fact: The World Health Organization (WHO) EMF Project has not reviewed the science since 1993. The WHO webpages on cell phones and cell towers are not based on a published scientific review. The WHO EMF Project webpages were written by a scientist who **used wireless industry money** to start the WHO EMF Project and who is now a consultant to industry. **In contrast, the WHO International Agency for Research on Cancer (a separate WHO entity vetted for conflicts of interest) determined RF radiation to be a Class 2 B "possible" carcinogen in 2011.** Many scientists now state **the evidence showing cancer has increased.**

Blue text is hyperlinked to source.

Cell Tower Companies warn Shareholders of Risk From Cell Tower Radiation

Why Don't They Warn Families Living Near Cell Towers?



Verizon 10-K Report

"our wireless business also faces personal injury and wrongful death lawsuits relating to alleged health effects of wireless phones or radio frequency transmitters. We may incur significant expenses in defending these lawsuits. In addition, we may be required to pay significant awards or settlements."



Crown Castle 10-K Report

"We cannot guarantee that claims relating to radio frequency emissions will not arise in the future or that the results of such studies will not be adverse to us...If a connection between radio frequency emissions and possible negative health effects were established, our operations, costs, or revenues may be materially and adversely affected. We currently do not maintain any significant insurance with respect to these matters."



AT&T 10-K Report

"In the wireless area, we also face current and potential litigation relating to alleged adverse health effects on customers or employees who use such technologies including, for example, wireless devices. We may incur significant expenses defending such suits or government charges and may be required to pay amounts or otherwise change our operations in ways that could materially adversely affect our operations or financial results."



T- MOBILE 10-K Report

"Our business could be adversely affected by findings of product liability for health or safety risks from wireless devices and transmission equipment, as well as by changes to regulations or radio frequency emission standards."

Cell Tower Companies warn Shareholders of Risk From Cell Tower Radiation

Why Don't They Warn Families Living Near Cell Towers?



AMERICAN TOWER®

NOKIA
CONNECTING PEOPLE



Qualcomm



ERICSSON

American Tower 10-K

"If a scientific study or court decision resulted in a finding that radio frequency emissions pose health risks to consumers, it could negatively impact our tenants and the market for wireless services, which could materially and adversely affect our business, results of operations or financial condition. We do not maintain any significant insurance with respect to these matters."

Nokia 10-K

"Although our products are designed to meet all relevant safety standards and other recommendations and regulatory requirements globally, we cannot guarantee we will not become subject to product liability claims or be held liable for such claims, which could have a material adverse effect on us."

Qualcomm 10-K

"If wireless handsets pose health and safety risks, we may be subject to new regulations, and demand for our products and those of our licensees and customers may decrease."

Ericsson Annual Report

"Any perceived risk or new scientific findings of adverse health effects from mobile communication devices and equipment could adversely affect us through a reduction in sales or through liability claims."

LEGAL & LIABILITY ISSUES



When a new cell tower or wireless network is proposed the first question to ask is "Do you have insurance for damages from long-term exposure to the radiofrequency radiation (RFR)?" Usually the answer is "No."

An Uninsurable Risk?

- Insurers rank wireless, cell tower, and 5G RFR non-ionizing electromagnetic radiation as a "high" risk, comparing the issue to lead and asbestos.
- Most insurance plans have "electromagnetic field exclusions" and do not insure for long-term RFR damages.
- Wireless RFR and non-ionizing electromagnetic radiation are defined as a type of "pollution" by wireless companies themselves.
- US mobile operators have been unable to get insurance to cover liabilities related to damages from long-term RFR exposure.
- Wireless companies warn their shareholders of RFR risk but do not warn users of their products, nor do the companies warn the people exposed to emissions from their infrastructure.

LEGAL & LIABILITY ISSUES



"Electromagnetic field exclusions" are clear and common in most insurance companies. It is applied as a market standard. This exclusion serves to exclude cover for illnesses caused by long-term EMF (non-ionizing radiation) exposure."

-Complete Markets "Electromagnetic Fields Liability Insurance"

"Electro-magnetic signals emitted by mobile devices and base stations may be found to pose health risks, with potential impacts including: changes to national legislation, a reduction in mobile phone usage or litigation."

-Vodafone 2017 Report ranks EMF as a "Principal Risk with "High" impact.

Swiss Re Institute (2019)

5G mobile networks classified as a "high," "off-the-leash" risk, stating, "Existing concerns regarding potential negative health effects from electromagnetic fields (EMF) are only likely to increase. An uptick in liability claims could be a potential long-term consequence" and "[a]s the biological effects of EMF in general and 5G in particular are still being debated, potential claims for health impairments may come with a long latency."

Crown Castle

"We cannot guarantee that claims relating to radio frequency emissions will not arise in the future or that the results of such studies will not be adverse to us...If a connection between radio frequency emissions and possible negative health effects were established, our operations, costs, or revenues may be materially and adversely affected. We currently do not maintain any significant insurance with respect to these matters."

Portland Oregon Public School Insurance

"Exclusions: This insurance does not apply to: Bodily injury, personal injury, advertising injury, or property damage arising directly or indirectly out of, resulting from, caused or contributed to by electromagnetic radiation, provided that such loss, cost or expense results from or is contributed to by the hazardous properties of electromagnetic radiation."

Verizon 10-K

"our wireless business also faces personal injury and wrongful death lawsuits relating to alleged health effects of wireless phones or radio frequency transmitters. We may incur significant expenses in defending these lawsuits. In addition, we may be required to pay significant awards or settlements."

Verizon Total Mobile Protection Plan (pg 10)

"Pollution" is defined as "any solid, liquid, gaseous, or thermal irritant or contaminant including smoke, vapor, soot, fumes, acid, alkalis, chemicals, artificially produced electric fields, magnetic field, electromagnetic field, sound waves, microwaves, and all artificially produced ionizing or nonionizing radiation and/or waste."

EXPERT VOICES

"The National Toxicology Program studies clearly showed that non-ionizing cell phone radiofrequency radiation can cause cancers and other adverse health effects. An important lesson that should be learned is that we cannot assume any current or future wireless technology such as 5G is safe without adequate testing."

-Ronald Melnick PhD 28 year scientist at National Institutes of Health

"I recommend public health organizations raise awareness and educate the public on why and how to reduce our daily exposure to wireless radio frequency radiation. Protective public health policy is needed now. It is time for regulatory bodies to fully evaluate the research and develop science based exposure limits that truly protect the public and the environment."

-Linda S. Birnbaum, PhD, Former Director, National Institute of Environmental Health Sciences and National Toxicology Program of the National Institutes of Health.

"Now we have 5G rolling out in massive quantities, without due diligence to determine are these sources of radiation safe not only for humans but for wildlife. And the answer is, no, they are not."

-Albert M. Manville II, Ph.D. is a 17 year Wildlife Biologist, Division of Migratory Bird Management, U.S. Fish & Wildlife Service

"Given the human, animal and experimental evidence, I assert that, to a reasonable degree of scientific certainty, the probability that RF exposure causes gliomas and neuromas is high."

-Christopher Portier PhD former Director of the United States National Center for Environmental Health at the Centers for Disease Control and Prevention and former Director of the U.S. Agency for Toxic Substances and Disease Registry.

EXPERT VOICES

“We should not wait to protect children’s brains. The science is now clear and compelling indicating that wireless technology is harmful to health, especially to for children. Wireless radiation is repeating the history of lead, tobacco and DDT.”

-Devra Davis PhD, MPH, President of Environmental Health Trust, founding director of the Board on Environmental Studies and Toxicology of the U.S. National Research Council, National Academy of Sciences, and a member of the team of the Intergovernmental Panel on Climate Change scientists who were awarded the Nobel Peace Prize in 2007

“I am calling on my industry to bring safer technology to market. The current implementation of technology is not safe. Take a good look at the science. This is about our children’s future. Do not be lulled into believing that 25-year-old standards can protect the youngest and most vulnerable. They simply cannot.”

- Frank Clegg, Former President of Microsoft Canada, CEO of Canadians for Safe Technology and

“The evidence indicating wireless is carcinogenic has increased and can no longer be ignored. If the World Health Organization International Agency for Research on Cancer were to meet to review all of the evidence, we believe the weight of evidence supports a new determination- that wireless radiofrequency radiation is a human carcinogen.”

-Anthony B. Miller MD, Professor Emeritus, Dalla Lana School of Public Health of the University of Toronto. Former Senior Epidemiologist for the International Agency for Research on Cancer and former Director of the Epidemiology Unit of the National Cancer Institute of Canada

“Most parents believe that cellphones were safety-tested before they came on the market. We assume that our federal health and environmental agencies regularly review the latest research and ensure that these incredible devices are safe. They do not. Children are not little adults. As we sadly learned with early childhood lead exposures leaving long-lasting impairments, the developing brain is particularly susceptible.”

-Jerome Paulson, MD , Professor Emeritus, George Washington University, Milliken School of Public Health, former Chair of American Academy of Pediatrics Committee on Environmental Health

Congress of the United States

Washington, DC 20515

September 13, 2019

Chairman Ajit Pai
Federal Communications Commission
445 12th Street SW
Washington, DC 20554

Dear Chairman Pai:

We are writing in regard to your August 8 proposal¹ to maintain the FCC's twenty-three-year-old radiofrequency (RF) radiation exposure limits, which have not been updated since 1996.

We want to be clear: the FCC has a serious responsibility to inform the American public about its research on the safety of RF radiation in wireless technologies. We are concerned that the FCC's continued appearance of equivocation on this issue has undermined the public's trust in the FCC and the federal government, and its continued lack of transparency could very well fuel allegations that the FCC is beholden to industry, rather than being concerned with protecting public health and safety.

As we've noted in previous correspondence, when the FCC's current guideless for RF safety were adopted in 1996, our society's relationship with and understanding of wireless technology was much different than it is today. While we understand that the FCC relies on scientific input from the Food and Drug Administration (FDA) and others to assess its RF safety guidelines, we are concerned that your proposal to maintain the 1996 safety standards fails to adequately address ongoing questions regarding the relevance of these standards to the realities and abundance of modern wireless technology.

A recent investigation by the *Chicago Tribune*² makes these questions abundantly clear. As you know, on August 21 the *Tribune* published test results showing that some popular cell phone models – including models made by Apple and Samsung – emit higher RF radiation levels than are allowed under the FCC's 1996 RF safety standards. For example, the Samsung Galaxy S8 tested at more than five times the FCC's exposure limit.

The *Tribune*'s study, conducted by an independent and FCC-accredited laboratory, found that the FCC's 1996 cell phone testing requirements do not accurately reflect modern cell phone usage. Namely, the current standards do not require cell phone radiation levels to be measured at a distance replicating when a phone is being held against the human body. As the *Tribune* states:

Companies testing a new phone for compliance with the safety limit also are permitted to position the phone up to 25 millimeters away from the body — nearly an inch — depending on how the device is used. That's because the testing standards were adopted in the 1990s, when people frequently carried cellphones on belt clips.

In one phase of the *Tribune* testing, all phones were positioned at the same distance from the simulated body tissue that the manufacturers chose for their own tests — from 5 to 15 millimeters, depending on the model. Apple, for instance, tests at 5 millimeters.

But people now often carry phones closer to the body, in their pockets, which increases their potential exposure to radiofrequency radiation.

¹ Federal Communications Commission, "Chairman Pai Proposes to Maintain Current Radiofrequency Exposure Safety Standards, 8 August 2019, <https://docs.fcc.gov/public/attachments/DOC-358968A1.pdf>.

² Chicago Tribune, "We tested popular cellphones for radiofrequency radiation. Now the FCC is investigating," 21 August 2019, <https://www.chicagotribune.com/investigations/ct-cell-phone-radiation-testing-20190821-72qgu4nzlfa5kyuhteieih4da-story.html>.

To assess this kind of exposure, the *Tribune* asked its lab to conduct a second phase of testing, placing the phones 2 millimeters away from the simulated body — closer than any of the manufacturers' own tests and far less than the maximum distance allowed by the FCC.

The 2-millimeter distance was chosen to estimate the potential exposure for an owner carrying the phone in a pants or shirt pocket. Under those conditions, most of the models tested yielded results that were over the exposure limit, sometimes far exceeding it.

The *Tribune* also points out that “authorities in the 1990s set the federal exposure limit based solely on the heating risks of cellphone radiation, building in a 50-fold safety factor. But some researchers — and lawyers — have questioned whether the limit is safe enough.”³ Additionally, the testing methods adopted in 1996 “didn’t address the anatomy of children and that of other vulnerable populations, such as pregnant women.”⁴

The *Tribune*'s investigation also notes that the FCC's standards only require a single cell phone from a manufacturer to pass RF radiation tests before the model can be brought to market. They state that the manufacturer is able to select the testing lab, as well as the sample phone to be tested.

Moreover, even when the *Tribune* modified its original tests at the request of feedback from manufacturers such as Apple, its tests still yielded some results over the FCC's safety limits. Apple once again alleged that the *Tribune* had not properly tested its iPhone models, but Apple declined to provide any specific details about the issues it claimed to have with the *Tribune*'s testing.

As you also know, a class-action lawsuit⁵ citing the *Tribune*'s investigation was recently filed in California, Illinois, and Iowa. The lawsuit states that phone manufacturers “intentionally misrepresented” the radiation safety of their products by telling consumers that these devices “were safe to use on and in close proximity to their bodies.”

In light of the *Tribune*'s findings, we are pleased the FCC has stated it will conduct its own testing of the cell phone models highlighted in the *Tribune*'s investigation. We urge the FCC to take this investigation seriously, conduct it in good faith, and inform the public about its findings with complete transparency.

Additionally, given the *Tribune*'s findings, we urge you to reconsider your proposal not to update the FCC's 1996 RF radiation safety standards. This is especially important given upcoming 5G small cell technology, which will utilize higher levels of RF radiation than ever before.

As we've previously indicated, when surveying publicly available research on the safety of RF radiation emissions, it is clear that additional research is needed to determine if RF radiation from wireless technologies has negative effects on human health. The American Cancer Society states that “most studies of people published so far have not found a link between cell phone use and the development of tumors. However, these studies have had some important limitations that make them unlikely to end the controversy about whether cell phone use affects cancer risk.” They continue:

First, studies have not yet been able to follow people for very long periods of time...Second, cell phone usage is constantly changing...Third, most of the studies published so far have focused on adults, rather than children...Cell phone use is now widespread even among younger children. It is possible that if there are health effects, they might be more pronounced in children because their

³ Chicago Tribune, “Lawsuit filed against Apple, Samsung after Chicago Tribune tests cellphones for radiofrequency radiation,” 29 August 2019, <https://www.chicagotribune.com/investigations/ct-cell-phone-radiation-lawsuit-apple-samsung-met-20190829-ye5h7fw6yvvauxpo367vqeg7pju-story.html>.

⁴ Chicago Tribune, “We tested...”, 21 August 2019.

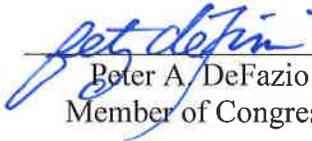
⁵ Andrew Cohen, et al. v. Apple Inc., et al., Case No. 5:19-cv-05322, United States District Court for the Northern District of California, 23 August 2019, <https://www.documentcloud.org/documents/6354255-Cellphone-lawsuit-August-2019.html>.

bodies might be more sensitive to RF energy. Another concern is that children's lifetime exposure to the energy from cell phones will be greater than adults', who started using them at a later age.⁶

As we've continued to urge, the FCC must be completely transparent about its research on RF radiation, and it must make tangible efforts to inform the public about this research in a detailed manner, so that it can back up the safety claims it continues to make about modern wireless technology. Until it does so, public concern about wireless technology will continue to grow.

Thank you for your attention to this matter. We look forward to your reply.

Sincerely,


Peter A. DeFazio
Member of Congress


Thomas R. Suozzi
Member of Congress

⁶ American Cancer Society, "Cellular Phones," <https://www.cancer.org/cancer/cancer-causes/radiation-exposure/cellular-phones.html>.

Congress of the United States
House of Representatives
Washington, DC 20515-3003

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March 28, 2019

The Honorable Ajit Pai
Chairman
Federal Communications Commission
445 12th Street, SW
Washington, D.C. 20554

Dear Chairman Pai,

I write to you regarding the Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment order, the public health concerns surrounding 5G technologies, questions surrounding the safety measures taken by your agency prior to implementation of this technology and the role of local governments in overseeing deployment and retaining control over infrastructure and rights-of-way in their communities.

As you know, current regulations governing radiofrequency (RF) safety were put in place in 1996 and have not yet been reassessed for newer generation technologies. Currently, the FCC's specific absorption rate (SAR) limits only apply to devices operating at frequencies up to 6.0 GHz. However, 5G technology operates at frequencies at and exceeding 24 GHz, which requires numerous small cell sites to be densely installed close to homes, schools, and workplaces. Despite the close proximity to sensitive areas where these high-band cells will be installed, little research has been conducted to examine 5G safety. The FCC has admitted, "the SAR probe calibration, measurement accuracy, tissue dielectric parameters and other SAR measurement procedures required for testing recent generation wireless devices need further examination".¹

On November 14, 2018 the FCC initiated an auction for 28 GHz and 24 GHz bands.² The deployment of these cells continues today despite little knowledge of the long-term health outcomes of this technology. Lacking existing studies into the human impact of high-band 5G cells, further investigation is needed to ensure that elevated RF levels in new locally deployed small cell sites will not be a health risk to communities on the ground.

As you know, the FCC's Declaratory Ruling on September 26, 2018 made several regulatory changes to local governments' ability to administer the rollout of 5G technology.³ These changes

¹ Federal Communications Commission, Office of Engineering and Technology, Laboratory Division, "SAR Measurement Requirements for 100 MHz TO 6 GHz"

https://apps.fcc.gov/kdb/GetAttachment.html?id=RUMcMDL7fmDLsdRSsbCNoA%3D%3D&desc=865664%20D01%20SAR%20Measurement%20100%20MHz%20to%206%20GHz%20v01r04&tracking_number=28242

² Federal Communications Commission, "AUCTIONS OF UPPER MICROWAVE FLEXIBLE USE LICENSES FOR NEXT-GENERATION WIRELESS SERVICES", Public Notice, FCC-18-109, August 3, 2018,

<https://docs.fcc.gov/public/attachments/FCC-18-109A1.pdf>

³ Federal Communications Commission, "Declaratory Ruling and Third Report and Order", FCC 18-133, September 26, 2018.

include restrictions on how towns and cities review small cell deployment applications, a new “shot-clock” that opens up local governments to lawsuits from 5G providers after 60 days without a final decision on a small cell application, and a cap on the fees that cities can charge for filing deployment applications. A city’s ability to regulate and manage 5G deployment is essential to protecting the health, safety and welfare of its residents.⁴

I have heard from a number of my constituents in Lavallette, New Jersey who are worried about the deployment of small cell 5G networks in their neighborhoods. Specifically, my constituents worry that FCC has failed to thoroughly explore all potential safety concerns regarding 5G technologies for human exposure. They are also concerned that local government possess little power to oversee and influence the deployment process. In order to ensure that my constituents are aptly educated on 5G’s potential impacts on public health, I would appreciate your response to the following questions:

1. What recent, independent scientific studies demonstrate the safety of 5G technologies?
2. Has the FCC or any other agency conducted research into potential long-term health outcomes of repeated exposure to radiofrequencies similar to those present in high-band 5G cells? If so, what were the results of such study?
3. Have any 5G telecommunications service providers conducted studies into the long-term health outcomes of repeated exposure to radiofrequencies similar to those present in high-band 5G cells? If so, what were the results of such study?
4. How are the FCC and 5G service providers working with local governments and municipalities to address citizens’ concerns concerning 5G implementation?
5. What procedure exists for residents to file complaints with the FCC regarding the installation of small cell 5G sites in their neighborhoods?

In order to ensure accurate and swift communication of information to my constituents regarding this issue, I respectfully request a prompt response to these questions.

I look forward to hearing from you on this important matter.

Sincerely,



Andy Kim
Member of Congress

CC: The Honorable Michael O’Rielly, Commissioner, Federal Communications Commission
The Honorable Jessica Rosenworcel, Commissioner, Federal Communications Commission
The Honorable Brendan Carr, Commissioner, Federal Communications Commission
The Honorable Geoffrey Starks, Commissioner, Federal Communications Commission

<https://docs.fcc.gov/public/attachments/FCC-18-133A1.pdf>

⁴ City of Philadelphia Law Department, “Comments of the City of Philadelphia”, September 19, 2018

[https://ecfsapi.fcc.gov/file/109192671202479/City%20of%20Philadelphia%20Comments%20to%20Draft%20Declaratory%20Ruling%20and%20Third%20Report%20and%20Order%20\(WT%2017-79%3B%20WC%2017-84.pdf](https://ecfsapi.fcc.gov/file/109192671202479/City%20of%20Philadelphia%20Comments%20to%20Draft%20Declaratory%20Ruling%20and%20Third%20Report%20and%20Order%20(WT%2017-79%3B%20WC%2017-84.pdf)



Congress of the United States House of Representatives

April 15, 2019

Chairman Ajit Pai
Federal Communications Commission
445 12th Street SW
Washington, DC 20554

Dear Chairman Pai and Acting Commissioner Sharpless:

I write to inquire about the status of the federal government's research into the potential health effects of radiofrequency (RF) radiation and its relation to the Federal Communications Commission's (FCC) current guidelines for what it considers to be safe RF exposure levels for humans.

As you know, the impending rollout of 5G technology will require the installation of hundreds of thousands of "small cell" sites in neighborhoods and communities throughout the country, and these installations will emit higher-frequency radio waves than previous generations of cellular technology. This means that Americans will be exposed to more non-ionizing RF radiation than ever before.

The FCC's current guidelines for RF safety were adopted in 1996, a time when our society's relationship with and understanding of wireless technology was much different than it is today. In fact, in August 2012 – almost seven years ago – the Government Accountability Office (GAO) released a report recommending that the FCC "should formally reassess and, if appropriate, change its current RF energy exposure limit and mobile phone tested requirements..."¹ The report continued:

The [FCC's] RF energy exposure limit may not reflect the latest research, and testing requirements may not identify maximum exposure in all possible usage conditions...By not formally reassessing its current limit, FCC cannot ensure it is using a limit that reflects the latest research on RF energy exposure. FCC has also not reassessed its testing requirements to ensure that they identify the maximum RF energy exposure a user could experience.

While I was pleased to see the FCC seek comments in 2013 on whether its RF safety guidelines should be reassessed,² it is unacceptable that six years later the FCC still has not conducted a reassessment of its 1996 guidelines.

Meanwhile, concern about exposure to RF radiation has been increasing. My constituents in southwest Oregon have expressed their concerns regarding possible health effects from increased RF exposure, particularly in light of upcoming 5G technology. They are not alone – Americans across the country are expressing similar worries about possible adverse health effects from this technology, and they are understandably demanding answers from the federal government.

Moreover, states and municipalities across the country, including in my congressional district, are hearing from citizens who are concerned about this technology being installed in their communities. Yet

¹ Government Accountability Office, "Exposure and Testing Requirements for Mobile Phones Should Be Reassessed," GAO-12-771, July 2012, <https://www.gao.gov/assets/600/592901.pdf>.

² Federal Communications Commission, "Reassessment of Federal Communications Commission Radiofrequency Exposure Limits and Policies: Proposed Changes in the Commission's Rules Regarding Human Exposure to Radiofrequency Electromagnetic Fields," FCC 13-39, 29 March 2013, <https://docs.fcc.gov/public/attachments/FCC-13-39A1.pdf>.

PLEASE RESPOND TO:

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because Section 704(a) of the Telecommunications Act of 1996 – legislation which I opposed – expressly prohibits state and local governments from regulating wireless infrastructure based on RF emissions, and because the FCC’s onerous new clarifying rules³ usurp local control over 5G small cell installations, states and municipalities are forced to depend on the federal government for information about the safety of 5G technology.

It is clear that the federal government has not been transparent enough about the current status of 5G RF radiation research and its guidelines on RF exposure limits. As Senator Richard Blumenthal noted in a February 2019 Senate hearing,⁴ the FCC’s and FDA’s responses to congressional inquiries on this issue have been less than satisfactory, merely reiterating general statements that 5G technology is safe without citing specific research or studies.

Even though the FDA states that it “believes the weight of scientific evidence does not show an association between exposure to radiofrequency from cell phones and adverse health outcomes,” it also states that “there is consensus that additional research is warranted to address gaps in knowledge...”⁵

I request the FCC and FDA provide answers to the following questions:

1. What scientific literature or research has the FCC and FDA used to determine that 5G technology will not cause any adverse health effects in humans? Please cite specific studies and research conducted.
2. What gaps exist in our current understanding of possible health effects from 5G technology, as well as the possible health effects of RF radiation writ large?
3. What efforts has the federal government taken to educate the public, as well as state and local governments, about its research on RF radiation and safety guidelines as it relates to 5G technology?

I strongly urge the FCC, FDA, and relevant agencies to be open and transparent about the research and methods used for determining RF safety guidelines, as well as any outstanding questions your agencies may have about this new technology. Full transparency is needed, and the American people expect and deserve no less from their government.

I look forward to your reply.

Sincerely,



PETER A. DEFAZIO
Member of Congress

³ Federal Communications Commission, “Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment,” FCC 18-111, 2 August 2018; <https://docs.fcc.gov/public/attachments/FCC-18-111A1.pdf>; and FCC 18-133, 26 September 2018, <https://docs.fcc.gov/public/attachments/FCC-18-133A1.pdf>.

⁴ Senate Committee on Commerce, Science, and Transportation; Hearing: “Winning the Race to 5G and the Next Era of Technology Innovation in the United States,” 02:03:59 – 2:08:50, 6 February 2019, <https://www.commerce.senate.gov/public/index.cfm/hearings?ID=06336057-CC60-45DF-A361-32D7401EE6CB>.

⁵ U.S. Food and Drug Administration, “Radiation-Emitting Products: Current Research Results,” <https://www.fda.gov/Radiation-EmittingProducts/RadiationEmittingProductsandProcedures/HomeBusinessandEntertainment/CellPhones/ucm116335.htm>

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SENATOR JAMES F. GAUGHRAN
SENATOR, 5TH DISTRICT

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July 23, 2019

Chairman Ajit Pai
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Dear Chairman Pai,

I am writing today to express concerns relayed to me by my constituents and local officials in my district regarding possible detrimental health effects caused by 5G small cells.

In my district and throughout Long Island, 5G small cell towers are being installed in residential neighborhoods in close proximity to houses, schools, and parks throughout the Fifth Senate District in New York. Many independent studies have shown negative health impacts on quality of health and they are requesting the technology be studied before further installation of these 5G small cell towers in their neighborhoods.

My constituents are concerned that until they can be sure that living in close proximity to cell antennas will not cause adverse health effects, we would like to see these "small cells" shut down and removed from our neighborhoods. We are also concerned with the long-term 24/7 exposure to 2G, 3G, and 4G that are currently in our neighborhoods. They are especially concerned with the more vulnerable populations such as children, fetus in the womb, and the immune compromised.

I am reiterating their requests for a study on the health impacts of 4G and 5G small cell towers and any potential association with cancer clusters. The health of our community is of the utmost concern and cannot be sacrificed. I encourage the Federal Communications Commission to expedite such a study, as this is a critically important issue for my constituents and our community, and provide my office with all relevant information used by the Federal Communications Commission to make 4G and 5G small cell tower safety determinations.

Thank you for your attention to this matter. If you have any questions or concerns, please contact Mario Ferone, in my office, at 516-922-1811 or ferone@nysenate.gov.

Sincerely,

A handwritten signature in black ink that reads "James F. Gaughran".

Senator James F. Gaughran
State Senator, 5th District

CC: Congressman Thomas Suozzi

Congress of the United States
Washington, DC 20515

April 16, 2019

The Honorable Ajit Pai
Chairman
Federal Communications Commission
445 12th Street, SW
Washington, DC 20554

Dear Chairman Pai,

I write to express the concern of constituents and local officials in my district regarding possible detrimental health effects of radiofrequency radiation (RF) emitted by 5G small cells.

From Huntington to Lake Success and beyond, small cell towers are being installed in residential neighborhoods in close proximity to houses throughout my district. I have heard instances of these antennae being installed on light poles directly outside the window of a young child's bedroom. Rightly so, my constituents are worried that should this technology be proven hazardous in the future, the health of their families and value of their properties would be at serious risk.

As I am sure you are aware, the National Toxicology Program (NTP) released a study in November of last year which linked RF radiation used in 2G and 3G networks to cancerous growths in rats.¹ Though this \$30 million, 10 year long study does not apply to 4G or 5G technology, the ubiquity of cellphone use throughout our country requires that this research be taken seriously in safety determinations of cellular technologies moving forward. While I understand that the FDA has reviewed this specific study, I wish to pass along my constituents' strong desire that further studies also be taken seriously and given a proper evaluation.² This is just one of the many pieces of research forwarded to my office by passionate activists who want to ensure the safety of their family, friends, and communities.

Another area of concern for many of my constituents is the FCC's outdated guidelines for safe human exposure to RF energy. The Commission's original updated guidelines were created in 1996 when much of the technology in use today was not yet available for widespread consumption, including 5G.³ In a letter dated December 17, 2018, Commissioner Carr explains

¹ National Toxicology Program, "Cell Phone Radio Frequency Radiation Studies," https://www.niehs.nih.gov/health/materials/cell_phone_radiofrequency_radiation_studies_508.pdf

² U.S. Food and Drug Administration, Office of the Commissioner. "Press Announcements - Statement from Jeffrey Shuren, M.D., J.D., Director of the FDA's Center for Devices and Radiological Health on the National Toxicology Program's Report on Radiofrequency Energy Exposure." U S Food and Drug Administration Home Page. November 1, 2018. <https://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm624809.htm>.

³ "Human Exposure to Radio Frequency Fields: Guidelines for Cellular Antenna Sites." Federal Communications Commission. March 12, 2019. <https://www.fcc.gov/consumers/guides/human-exposure-radio-frequency-fields-guidelines-cellular-and-pcs-sites>.

that safe exposure limits have been altered and updated in the FCC's guidelines since that time. How have these safety determinations been made and does the FCC plan on releasing the data it used to set these new limits?

5G will bring about a transformation to how people and networks communicate. While I understand the importance of this technology for the future of the American economy, I believe we must also be as certain as possible that it is safe. I respectfully request that you provide my office and all relevant House Committees with the information used by the FCC, FDA, and other related health agencies to make 5G safety determinations.

Please contact Michael Christesen (michael.christesen@mail.house.gov) in my office with any questions.

Sincerely,


Thomas R. Suozzi
Member of Congress

(TRS/mcc)

Wireless Hazards

by Barbara Koeppl
Dec 28, 2020 | [Health](#)



PHOTO CREDIT: Verizon Wireless video advertisement



[Online link for Wireless Hazards](#)

If you think your cellphone is safe, have you considered why you believe that? Is it a fact or is it based on carefully crafted messages that you've read or heard?

For the past few decades, the telecom wireless industry and its enthusiasts have heralded cellphones as the greatest achievement of the late 20th and early 21st centuries. But as their use soars, scientists

worldwide worry about their hazards and have produced over 2,000 studies that tell a darker tale. They warn that the devices and antennas that power them expose humans and wildlife to nonionizing low-frequency electromagnetic fields—also called cellphone, microwave, or radio-frequency radiation. These studies indicate that when people and animals are exposed, they can develop brain, thyroid gland, prostate gland, acoustic nerve, and breast tumors, and other diseases.

Not surprisingly, the industry argues this type of radiation is safe, because it is unlike the high-frequency ionizing radiation used in X-rays, which can directly damage DNA.

Still, scientists say low frequency doesn't mean harmless. For example, based on data from the U.K. Office of National Statistics, Alasdair Philips, an engineer, scientist, and trustee of Children With Cancer U.K., found that cases of brain tumors (glioblastomas) in Great Britain from 1995 to 2015 mushroomed, from 983 to 2,531.

Why? Philips says, "There's adequate proof that exposure from wireless devices affects cancer cells. Even if they don't start the cancers, they speed up the rate at which the cancer cells multiply. This is true of all the devices—cellphones, tablets, and cordless phones people use in their homes—since they have built-in antennas that communicate with cell towers.

"The exposure is quite significant because people hold their devices near their heads for hours while they stream videos and other materials." He warns that the exposure is particularly potent when the reception is poor: "At such time, the signal's strength can increase by even a millionfold."

Philips says the upsurge in tumors is mainly among those over 50—since this age group typically has more tumors. But, although very few

10-to-15-year-olds get brain tumors, that number is also increasing. He adds that “besides promoting cancer, microwave radiation makes lower-grade tumors become more aggressive.”

Robert Kane, an electromagnetics engineer who designed and tested wireless devices for Motorola and other firms starting in the 1980s, warned of the dangers in his book *Cellular Telephone: Russian Roulette* (2001). Given his position inside the industry, he was able to confirm that cellphone companies knew their products could harm and even kill, but, like the tobacco, asbestos, and fossil fuel industries, they kept the news quiet. Besides the increased risk of tumors, Kane also described hundreds of studies since the 1950s that found that low-level radiation damaged DNA and tissues and caused loss of memory and motor skills, and cataracts. Kane died of a brain tumor in 2002.

The industry rejects the data. Its main trade group, the Cellular Telecommunications Industry Association, states “wireless devices do not pose a public health risk for adults or children.” Although it admits devices and cell towers emit radio-frequency radiation, it says this exposure can only cause acute, short-term overheating of human and animal tissues. But the CTIA also insists this doesn’t happen, because the amount of radiation is minuscule. Instead, it argues that long-term illnesses such as cancer are a fiction of marginal alarmist researchers.

Even the \$30 million, decade-long study by a National Institutes of Health division called the National Toxicology Program, the results of which were released in 2018, didn’t dent industry’s denials. For two years, NTP scientists exposed rats to cellphone radio-frequency radiation and found “clear evidence of cancer in the male rats’ heart cells, some evidence of increased brain gliomas (brain cancer) and adrenal gland tumors, DNA damage in the brains of male and female rats and mice, lower birth weights of female rats’ offspring, and decreased sperm quality.” Ron

Melnick, a senior scientist (now retired) at the NTP who led the design of the study, says they also found tumors in the rats' prostate glands. The numbers were confirmed by a panel of experts.

Still, the story was squashed: the press mostly ignored or dismissed it. And the U.S. watchdog agencies—the Federal Communications Commission and the Food and Drug Administration, which set the safety regulations for wireless devices—disputed the findings. The FDA argued that “the study was not designed to test the safety of cellphone use in humans, so we cannot draw conclusions about the risks [to humans] from it.” Melnick says, “This statement was odd because when we were designing it, the FDA told us an animal study was needed. But when we announced the results, the FDA said, ‘The current safety limits for cellphone exposure, set in 1996, remain acceptable.’” And the FCC concurred.

Melnick sought feedback from scientists outside the NTP and asked one who worked for Motorola to discuss the results. “He refused. He told me we already have lots of studies that don't show these effects,” Melnick says.

The FDA and FCC claimed the results were skewed because NTP scientists exposed the rats' entire bodies to higher doses of radiation than cellphones typically emit. But their arguments were countered by scientists at Italy's Ramazzini Institute (a nonprofit cancer research center in Bologna) who exposed 2,500 rats in the fetus and until their death to lower doses of radiation than those emitted in cellphones. These animals developed the same rare heart cancers.

Why are the deniers so adamant? “It's all about money, since there are billions, even trillions, at stake,” says Jerry Phillips, a biochemist who directs a science center at the University of Colorado. Indeed, in 2018, global cellphone sales were more than a half-trillion dollars.

The industry is spectacularly successful in ensuring that its message echoes far and wide: its profoundly deep pockets purchase seats at all the right tables in the global and national watchdog agencies, media organizations, and scientific associations—which manage the misinformation. Thus, industry’s billions decide which scientists and studies get funded or defunded, which get quoted or discredited, which agency commissioners bounce back and forth from telecom companies and corporate law firms, and how dissenters—such as U.S. states and cities—are sued and usually silenced.

At present, the industry and its backers are hyping 5G—the newest generation of devices, following 2G, 3G, and 4G. Online, in newspapers and on television, we are told 5G will change life as we know it—with vastly increased speeds for streaming material and devices that are able to communicate with each other (sometimes called “the internet of things”). The ads also promise that 5G will add \$500 billion to the U.S. economy. Verizon, a key player, even claims it “will help doctors see cancer like never before.”

The scientists worry even more. They say 5G technology uses millimeter waves, along with microwaves (the type in current devices). Because 5G waves can only travel short distances, antennas and towers need to be installed every 300 to 600 feet on every block across the country, to receive and send signals. And this, Philips says, “increases the exposures exponentially.”

Joel Moskowitz, director of the Center for Family and Community Health at the University of California, Berkeley, says “because the technology is so new, we have no way to know about the long-term health effects. But we do know that millimeter waves are absorbed in our skin and on the cornea and can harm the immune, nervous, and cardiovascular systems.”

The U.S. Government Accountability Office agrees—although it buried the warning on page 42 of a report it released this past November. The GAO quotes a National Cancer Society scientist who said “no studies of 5G frequencies have been conducted on the long-term health effects because the technology hasn’t been deployed long or widely enough.” Worse, the scientist warns the effects may not be known “for many years, because some outcomes could take decades to develop.”

Still, the GAO has hyped the 5G debut, as have the other U.S. agencies: It posted a video featuring Tom Wheeler, the former FCC chair and CTIA CEO, who, not surprisingly, never mentioned the health issues.

However, given the industry’s daily drumbeat, there is a dramatic disconnect between the critics’ concerns and public awareness. As a result, only 5 percent of U.S. adults worry that cellphones are harmful, and parents buy them for their children: in 2019, 53 percent of children under 12 and 84 percent of teens had them.

Further, few people know that when reception is poor and phones show just one or two bars—say, when users are in subways, elevators, cars, basements, or some rural areas—the devices need more energy to communicate with cell towers and other phones. Philips explained that this leads to a massive increase in exposure. This conclusion was also [noted](#) in a 2017 California Department of Public Health advisory titled *How to Reduce Exposure to Radiofrequency Energy From Cellphones*, which led the department to warn the public not to use phones in such places.

For their part, the manufacturers and telecom companies don’t mention this concern. Instead, they inform users about the proper distance to hold phones from their bodies to avoid excessive exposure (from 5 to 25 millimeters away—about one-fifth of an inch to an inch). But they bury even these modest advisories deep inside the owner manuals.

Moskowitz says, “The problem is that we really don’t know what distance is safe for people who use the devices over many years.” Thus, he and other scientists I interviewed said they only use wired landlines at home; and, when out, they carry cellphones in backpacks, brief cases, or tote bags.

However, the industry’s message is so widely accepted that contradictory information is routinely discarded. One scientist (who asked for anonymity) told me he recently was asked to advise a state committee about 5G guidelines. “When I tried to tell them about the hazards from the hundreds of thousands or millions of new antennas that will be installed, they weren’t interested. Instead, they only looked at materials from a telecom company, which said the ‘greatest risks from cellphones are traffic deaths due to drivers being distracted.’”

Similarly, when the U.K. National Radiological Protection Board warned, as early as 2000, that people should keep calls short and use hands-free earpieces, the FDA and FCC insisted “the scientific evidence does not show a danger.”

The disconnect was striking at two meetings I attended in Washington D.C. about the coming of 5G. Both had panelists from the D.C. government and industry who championed its benefits. During the Q&A, when someone asked about safety issues, panelists confidently claimed there were “none.”

Compromised watchdogs

How does industry carry it off? First, the watchdog agencies continually reaffirm the industry’s message, and because of their authority, they’re considered objective. Yet their conflicts of interest are pervasive. For example, in 2013, President Obama named Tom Wheeler, the CEO of the

main trade group, the CTIA, to chair the FCC. In a 2016 talk, Wheeler said, “We won’t wait for standards to be developed. . . . Instead, we will rely on the private sector to produce them.” On 5G, he told doubters to “stay out of the way. . . . Tens of billions of dollars in economic activity . . . is what’s important.”

President Trump replaced Wheeler with Ajit Pai, a former Verizon legal counsel and attorney at Jenner & Block, which represents the CTIA. As Jenner & Block’s site boasts, “No firm has the experience and credibility we enjoy before the FCC.”

This is not an idle claim. Pai—the regulator in chief—dislikes regulations. In 2018, he repealed the FCC’s net neutrality rules, which, *Los Angeles Times* business columnist Michael Hiltzik noted, “involves billions of dollars in potential profits for Verizon and other firms.”

Moreover, Pai is determined to quash 5G opponents. In 2018, the FCC issued an order that would force cities to stop blocking companies that were installing 5G antennas. The order also lets the firms sue cities if they don’t approve their installation plans in 60 or 90 days. Further, it says that companies needn’t wait for health or environmental studies to prove the equipment is safe: instead, they only have to say they comply with FCC rules.

The FDA is just as obliging. Jeffrey Shuren, who heads its Center for Devices and Radiological Health, is an industry loyalist. As Justin Klein, a partner at Vensana, a medical technology venture capital firm, observed, “Shuren has won the trust of the device world through . . . his ‘industry-friendly record.’” A May 2019 CBS news report confirmed this: when France banned certain breast implants that researchers linked to lymphoma in 2019, Shuren said they were safe—and left them on the U.S. market.

Shuren also does not welcome whistleblowers. A 2012 *Orthopedics Journal* story said that when he ran the FDA unit approving new devices, nine of its scientists warned that a CT scanner they were evaluating could cause cancer. Within months, Shuren fired all nine. Two years later, a U.S. congressional committee reported that Shuren had bugged the scientists' computers to record their activities.

In fact, the U.S. federal government thrives on a thriving telecom industry. In *Captured Agency* (a monograph published in 2015 by Harvard's Center for Ethics), journalist Norm Alster wrote that the government had reaped nearly \$100 billion in prior years from selling space on the electromagnetic field spectrum, through which the companies send their signals. Alster says local governments also prosper, collecting an average of 19 percent from users' cellphone bills.

Other deniers

Henry Lai, a University of Washington bioengineer researcher, says the industry's influence is so profound that "even the American Cancer Society accepts its views." So, too, have other respected groups, such as the World Health Organization and the U.S. Centers for Disease Control and Prevention, which repeat the "no radiation problems" refrain.

For example, when the National Toxicology Program released the results of its study—citing cancers in the heart cells, brains, and adrenal glands of laboratory rats exposed to cellphone emissions—an American Cancer Society site said, "Updated Cellphone Study Findings Still Inconclusive," the exact opposite of what the scientists concluded. In fact, the ACS's chief medical officer at the time, Dr. Otis Brawley, said, "The evidence for an association between cellphones and cancer is weak."

Could the ACS have industry ties? I asked Kathi Di Nicola, director of ACS media relations, for its donor list. “We do not release individual or partner giving, unless required by law,” she emailed back. But an ACS site called “Our Partners” lists Goldman Sachs, Bank of America, and JP Morgan, whose clients include the telecom giants; other partners are the giants themselves, such as Microsoft, United Technologies, and World Wide Technology.

For its part, the CDC switched its position about wireless dangers without offering any reasons. Theodora Scarato, executive director of the Wyoming-based nonprofit group the [Environmental Health Trust](#), which works with communities and health professionals to promote research and policies, says that, in June 2014, the CDC website recommended “caution in cellphone use” and noted that “more research is needed . . . before we know for sure if cellphones cause cancer.”

Just two months later, most of the message had disappeared and was replaced by one line: “There is no scientific evidence that provides a definite answer to that question [can using a cellphone cause cancer?].” Scarato notes that her nonprofit submitted hundreds of Freedom of Information Act requests to the CDC to determine why; in doing so, it learned that the CDC [had hired Kenneth Foster](#), an industry consultant, in 2015, to write that agency’s new web pages on the health effects of wireless technology.

The WHO has also straddled both sides. Just one month after its division the International Agency for Research on Cancer defined cellphone radiation as a *possible* human carcinogen in 2011, a WHO fact sheet claimed “no adverse health effects have been established.” However, Alasdair Philips notes that many IARC scientists now believe the group should revisit the issue and change the assessment from possible to probable.

Further, the WHO consistently adopts the views of the International Commission on Non-Ionizing Radiation Protection, or ICNIRP, which, since its founding in 1992, has argued that electromagnetic frequency, or EMF, radiation can only cause damage by heating body tissues, which, it says, wireless devices don't do. The WHO also defers to the United States (whose position is articulated by the FDA and the FCC), which, until recently, when President Trump cut U.S. funding, was the WHO's largest contributor.

Dariusz Leszczynski, a University of Helsinki biochemist, says ICNIRP's views haven't changed because its current members only choose new members who share their beliefs. His opinion is confirmed by James Lin, a University of Illinois professor of engineering, physiology, and biophysics, who was an ICNIRP member for 12 years. He told me, "If you look at the group's output, it says the same things industry says."

Moreover, many ICNIRP members have serious [conflicts of interest](#). While they're supposed to list their income on Declaration of Interests forms, they often don't. For example, Michael Repacholi, an Australian biophysicist and ICNIRP's first chair, also founded a WHO project in 1996 to study cellphone radiation effects. But Louis Slesin, editor of *Microwave News*, reported in 2006 that Repacholi admitted the telecom industry had funded half the WHO project's budget. When he left WHO in 2006, Repacholi soon became an industry consultant.

Andrew Wood, who is on the ICNIRP's Scientific Advisory Group, runs a lab at Swinburne University in Australia supported by the Telstra Corporation, which builds and operates digital networks, provides mobile and internet access, and is that country's largest telecommunications company. Telstra gave Wood's lab some equipment and sent its staff there to test Telstra's products.

Rodney Croft, an ICNIRP member since 2008, told an Australian Broadcasting Corporation news show, “A lot of research . . . has clearly shown there aren’t any health effects.” However, Croft didn’t mention that the research center he directed was created with Telstra funding and lab equipment.

Rene de Seze, in ICNIRP for over a decade, left his Declaration of Interests form completely blank—not listing grants from France Telecom or his work for Motorola.

Even the National Institutes of Health has minimized the radiation hazards. For several years, it sponsored *Healthy Building Roundtable* conferences, the last one in 2018. On July 19 and 20, speakers on the Electro Magnetic Frequency panel [described](#) the dangers of wireless devices, circulated material at the conference, and posted it on the NIH–Healthy Buildings Roundtable website. It said, “Current FCC public radiation exposure guidelines were set decades ago, based on the outdated premise that devices need to emit enough heat to raise the temperature of one’s skin to cause harm. There are now [over 25,000 articles published](#), and the majority of non-industry funded studies show great evidence of biological harm at the non-thermal level.”

The message still appeared in September, but by early October, it had disappeared. So, too, had any mention of the EMF panel.

The loyal press

Besides the industry’s sway with the agencies, its influence on the press and media means that coverage of wireless devices is almost always upbeat. First, the industry buys full-page ads that promote its services and products and now continually tout 5G. Then there are the owners’ personal conflicts. For example, *The New York Times*’ largest single

stockholder is Carlos Slim—the world’s richest man in 2013—who holds 17 percent of the newspaper’s stock and whose company, America Movil, is Latin America’s biggest telecom provider. And Verizon is partnering with the *Times* on a 5G project.

Most press and media repeat the agencies’ positions and debunk or ignore studies that describe the dangers. Since *The New York Times* is America’s paper of record, its coverage is instructive.

In a May 2019 *Times* story, “your 5g phone wont hurt hurt you. but russia wants you to think so,” the journalist William Broad quoted Marvin Ziskin, a Temple University professor of radiology, who claimed, “5G emissions, if anything, should be *safer* [emphasis added] than previous generations’ exposure of the body’s internal organs.” But Ziskin’s papers, many co-authored by Kenneth Foster, a professor in the Department of Bioengineering at the University of Pennsylvania, are funded by the Wi-Fi Alliance and the Mobile & Wireless Forum, or MWF, a trade group whose members include Apple, Motorola, Samsung, and Sony. As industry favorites, Foster and Ziskin were invited to chair MWF’s 2016 workshop sessions in Belgium, and Foster gave the keynote address.

Broad also quotes David Robert Grimes, whom he identifies as an Oxford University cancer researcher. Besides his statements supporting 5G and wireless devices, Grimes discredits the work of David Carpenter, former dean of SUNY’s School of Public Health in Albany who has long warned of cellphone hazards: he claims that “Dr. Carpenter’s scariest alarms have been widely dismissed by scientific bodies the world over.”

But Grimes isn’t a reliable judge. His website has a link to his Oxford work, but the link, when clicked, states, “The page is not found.” Grimes’s site also notes his work at Queen’s University in Belfast, but, as of December 2019, Queen’s no longer listed Grimes in its online directory.

Moreover, Grimes's research is on human consumption of oxygen—not cellphone radiation. And although Broad doesn't mention this, Grimes gets industry funds: in one of his papers, Grimes thanks the NVIDIA Corporation for "generous hardware donations" to his research project on radiotherapy (NVIDIA makes parts for smart phones, tablets, and game systems and had an income of \$4 billion in 2018). Grimes also thanks Cancer Research U.K. for its support—an institute that partners with the Francis Crick Research Institute, whose chair is Baron Edmund John Philip Browne, British Petroleum's former head and now chair of Huawei Technologies U.K.

In July 2019, the *Times* ran another story, titled "5G, don't fear the frequency," under a huge multicolored drawing of panicked people. Broad writes that Bill Curry, a physicist who warns about radiation dangers, produced "flawed reports" about the damage of microwave radiation, which were adopted by "alarmist websites." Again, he quotes Grimes, who states, "If phones are linked to cancer, we'd expect to see a marked uptick. Yet we do not." This assertion contradicts research conducted by Alasdair Philips, who used numbers from the U.K. Cancer Registry to document the increase in aggressive brain tumors.

In fact, Broad's articles reveal consistent biases. In reviewing two books on global warming in 1998, he said, "[W]e live in a great climate experiment, the outcomes of which, good or bad, no one is likely to forecast with any certitude." This assurance came nearly 20 years after a National Academy of Sciences report predicted global warming of 2 to 3.5 degrees Celsius (3.6 to 6.3 degrees Fahrenheit)—with greater increases at high latitudes.

In 2007, Broad called Al Gore's documentary *An Inconvenient Truth* "exaggerated." To prove his point, he quoted Don Easterbrook, a geologist who saw "a lot of inaccuracies." But this is the same Easterbrook who told

a Washington State Senate Energy, Environment, and Telecommunications Committee that “global warming ended in 1998.”

Broad’s science denials resurfaced in October 2019, when he wrote that plastics, a major source of ocean pollution are “less devastating than usually portrayed.” To support this assertion, he quotes a marine chemist who claims that “sunlight can degrade them in centuries or even decades,” not a timeline that accords with sustainable management of the world’s marine and coastal environments.

Although most press and media support the industry’s position, there are some rare exceptions. For example, the *Chicago Tribune* launched its own study to measure the radiation from Apple, Samsung, and Motorola cellphones. In an August 2019 article, the *Tribune* said the testing laboratory found that many models exceeded the FCC exposure standards, “particularly when tested close to the body.”

The *Baltimore Sun*, covering a May 2016 Pediatric Academic Society annual meeting, quoted physicians who warned parents to limit their children’s cellphone use. And in October 2005, a *Florida Sentinel* story noted that researchers worried that “radiation enters users’ heads, and over time might pose serious health risks, including cancer.”

Research and retaliation

Industry’s impact on research is also enormous. Henry Lai, the University of Washington bioengineer researcher, reviewed 326 studies on radio-frequency radiation carried out from 1990 to 2005 and found that half showed harmful biological effects, while half did not. When he checked who funded which ones, the numbers diverged dramatically: of those that were independently funded, 70 percent found harmful effects,

while among those funded by industry, only 30 percent reported finding them.

For researchers who refute the message, retaliation is certain. A few examples are useful. John Allis, a physical chemist, and Carl Blackman, a biophysicist, were among a group of scientists at the Environmental Protection Agency studying low-intensity EMF radiation from the 1970s until the mid-1980s—to determine its effect on brain tissue. Allis says that although ‘low’ sounds benign, it “penetrates more deeply than X-rays.” Since their research predated cellphones, they studied the radiation from electric power lines and the military’s radar installations.

“We exposed newly hatched chickens’ brains to it and found that this changed their brain tissues. It was a crucial discovery that we wanted to study further, but EPA stopped our funds,” Blackman says. He then got Department of Energy support, but it also ended, and his equipment was thrown away.

Why? Allis says that “in the 1980s, the Reagan administration was pushing ‘Star Wars,’ which was thought to need nonionizing radiation to make it work. The scuttlebutt was that Washington didn’t want to know it had negative effects. So it stopped the funds.”

Lai and his research partner, N.P. Singh, a professor of bioengineering at the University of Washington, exposed rats’ brains to radio-frequency radiation at an intensity the FCC said was safe. But after just two hours, the radiation broke or damaged the DNA in their brain cells—which can lead to mutations and cancer. When they published their results in a 1995 issue of *Bioelectromagnetics*, Motorola cut their funds and counterattacked: Slesin posted a leaked memo in a 1997 *MicrowaveNews*, which showed (under [Media Strategy](#), p.13) that Motorola wrote to its public relations firm telling how to discredit them.

Lai and Singh then got a Wireless Technology Research grant (under the trade group CTIA) to continue their studies. But Lai says WTR continually tried to “dictate the design of our experiments.” After many confrontations, George Carlo, WTR’s head, wrote the University of Washington president (Richard McCormick), threatening legal action and telling him to fire Lai and Singh. McCormick refused. The scientists still had NIH funds to continue their research on extremely low-frequency fields, and published a paper in 2005. But it was their last.

Om Gandhi, a University of Utah professor emeritus, studied how humans absorbed cellphone radiation and, by the 1990s, was focusing on children because, as he explains, “their skulls are thinner than adult skulls and they absorb much more.” He also found that for every millimeter closer to their heads people hold their phones, the absorption rate is 15 to 30 percent higher. When he published these results, his funders stopped funding. “Without the grants, I had to close my lab,” he said. Some years later, Devra Davis, an epidemiologist who co-founded the [Environmental Health Trust](#), co-wrote a paper with Gandhi. She says that a five-year-old child’s skull absorbs about 10 times as much radiation as an adult’s skull. But when companies test phones, they use a one-size-fits-all model based on the head size of an adult male.

Jerry Phillips (before he went to the University of Colorado) was at the Veterans Affairs Medical Center in Loma Linda, California, where the team with which he worked got Motorola funds to study EMF radiation. The researchers exposed rats in the fetus and newborns to the radiation and found that under certain conditions, the signals affected brain tissues. “Motorola didn’t want to hear this and told us not to present our results. But we did, anyway,” Phillips says.

After this, the company asked the team to study the DNA breaks that Lai and Singh had found, but he said, “Motorola wanted us to reach different

conclusions. What we learned was that different exposures increased *and* decreased DNA damage. Motorola didn't like this, either, since it wanted to hear that there were no effects. It told us to do more research and not publish our data. A friend at Motorola advised me 'give Motorola what it wants, or this could harm your career.'

"Although I knew government funds hadn't been available for such studies for years, I couldn't work with Motorola's restrictions. So I took myself off the project. If I hadn't, Motorola would have. I left California and haven't done this type of research since."

Phillips says Motorola asked several other researchers to disprove what the group at Loma Linda, as well as Lai and Singh, had found about the damage to cells. And some obliged the company. "It's possible to do this, since the way you design studies determines what you'll find.

"This is how industry manages to confuse the public. It stops funding research it doesn't like and promotes the results it likes. It also says the studies cancel each other out." That is, if some find harmful biological effects and others don't, then the former don't count. "This isn't correct," Phillips says.

Lai adds that industry enthusiasts always claim there's a lack of research about the long-term effects, but this isn't true: over 500 epidemiological and animal studies have shown that cellphone radiation causes biological damage. Lai told Slesin, "The industry says half the studies don't show effects. But even if this was true, could the other half all be garbage?"

Reseachers' findings

Brain tumors and blood leaks Several scientists have reported on these health problems. Berkeley's Joel Moskowitz, who writes a blog on

electromagnetic radiation, says that in 2017, several journals, such as *Biomedical Research International* and *Neurological Sciences*, published various scientists' reviews of the many studies carried out on brain tumors. They found that "each reported a 'statistically significant' link between heavy cellphone use (of 10 or more years) and brain tumors, especially on the side of the head where people hold their phones (called *ipsilateral* use)."

One review was by Lennart Hardell and Michael Carlberg, whose earlier work on brain tumors is considered the gold standard and was a key reason the International Agency for Research on Cancer classified cellphone radiation as a possible carcinogen. In their review, Hardell and Carlberg found that the highest risk of glioma—brain cancer—occurred among the heaviest users, and they reported in a 2013 issue of the *International Journal of Oncology* that people using cellphones at least 30 minutes a day for nine years "had nearly three times the glioma incidence. If they started as teenagers or earlier, the risk was four times higher." They also found meningiomas (slow-growing, mostly nonmalignant brain tumors) and acoustic neuromas (tumors on auditory nerves leading from the inner ear to the brain).

Further, a \$25 million Interphone Study, funded by the European Union and others, was carried out by scientists in Australia, Canada, Denmark, Finland, France, Germany, Israel, Italy, New Zealand, Japan, Norway, Sweden, and the U.K. They compared approximately 5,000 cases of tumors to a similar-size control group. Many of the researchers said the results were consistent with previous studies that showed increased risks for glioma or acoustic neuroma tumors among the heaviest cellphone users.

Two other studies also found serious risks. The French CERNAT study reported in May 2014 that those using phones 30 minutes a day for five

years had a higher risk of brain tumors. And a Chinese study by J. Tang (published in *Brain Research* in 2015) found that rats exposed to cellphone radiation had leakage in the blood-brain barrier and cognitive impairment.

DNA damage Besides the Lai and Singh studies, the reflex study (for which the European Union gave three million Euros to 12 institutions) found that cellphone radiation damaged human cells and DNA. As noted earlier, the NTP study also found DNA damage in rats and mice.

Thyroid tumors Berkeley's Moskowitz says the incidence of thyroid tumors—especially the papillary type, which is the most sensitive to electromagnetic field radiation—is increasing in many countries. He explains that because of the way phones are designed, much of the radiation is directed toward the neck, where the thyroid gland is located. He says the CDC reported a rapid rise of these tumors among children in the United States, and Hardell and his colleagues wrote about this in 2016. Finally, he says a 2019 Yale University study found increased thyroid cancer among heavy cellphone users.

Male infertility The Cleveland Clinic Center for Male Fertility found that when men carried phones in their pants pockets, their sperm were weakened and reduced, which can cause infertility.

Hypersensitivity A growing number of physicians and scientists are reporting that some individuals are particularly sensitive to EMF radiation. Their symptoms, which can be quite pronounced, include tinnitus, vertigo, headaches, fatigue, and memory loss.

Insurance companies deny coverage

Interestingly, the risk-averse insurance industry has been reluctant to offer coverage for the companies or those who use the devices. For example, insurance authority Swiss Re classified wireless devices as “high risk,” while Lloyd’s of London underwriters adopted the “Electromagnetic Fields Exclusion Clause”: this means it will not cover “damages or illnesses caused by continuous long-term non-ionizing radiation exposure through mobile phone use.” As journalists Mark Hertsgaard and Mark Dowie noted, in a July 2018 *Guardian* article, they didn’t find a single insurance company that would sell a policy covering cellphone radiation. “Why would we?” one executive told them . . . pointing to over two dozen lawsuits against wireless companies, demanding \$1.9 billion in damages.

Countries’ concerns

Unlike the United States, some countries have tightened their exposure rules. For example, Belgium banned companies from marketing phones specifically designed for children under seven.

Cyprus banned Wi-Fi in nursery schools and kindergartens and launched an advertising campaign to educate parents. Also, it removed Wi-Fi from Archbishop Makarios hospital.

France, which has the world’s strictest limits, banned wireless devices in daycare centers for children under three, required Wi-Fi to be turned off in elementary schools when not in use, and ordered towns to map the locations of antennas, measure their radiation levels, and give this data to the public. Also, it required that ads state the various models’ exposure levels (with fines of up to 75,000 Euros if they don’t comply); further, the ads may not show children using phones or people holding the devices next to their heads.

India reduced the cell tower radiation limit to one-tenth of the cap recommended by ICNIRP, and some states and cities ordered companies to remove their towers that were located near hospitals and schools.

Israel banned Wi-Fi in kindergartens, limited it in first and second grades to three hours a week, required companies to list the phones' radiation levels, and banned ads that show children using phones. Haifa's school district required computers to be hard-wired.

In Poland, Krakow's mayor distributed free meters to its citizens to measure their devices' exposure levels and tightened zoning rules, which limit the areas where towers can be located.

And in Switzerland, Geneva is one of several cities and towns that placed a moratorium on 5G.

States, cities, and scientists fight back

Alarmed about the hazards from wireless devices, 254 scientists from 44 countries have urged the United Nations to toughen the exposure guidelines and "educate the public about the health risks." The U.N. has not replied.

With the advent of 5G, warnings are even stronger: By October 2020, 407 scientists and physicians appealed to the European Commission "to halt the roll-out of 5G . . . which will substantially increase exposure to radiofrequency electromagnetic fields." This has also been ignored.

Many U.S. states, cities, and counties also worry. For example, New Hampshire legislators created a commission of experts to study EMF effects. In their report, which was released this November, the experts

recommended 15 actions: among the most important, they asked the FCC to study the environmental impact of the 5G antennas and towers and locate them further from schools and homes.

Representative Patrick Abrami, who heads the commission, invited Frank Clegg, Microsoft Canada's CEO for 14 years, to meet with them. Clegg told them, "The industry only focuses on getting its products to market but doesn't deal with health and safety issues. It's self-policing, so we're seeing a Wild West scenario regarding the guidelines. I'm not aware of a single study which shows 5G technology is safe."

How did the ex-CEO of Microsoft Canada do such a turnaround? Clegg says, "After I retired in 2005, I talked to scientists and became convinced the devices can harm you. At this point, my wife and I founded Canadians for Safe Technology to raise people's awareness about the dangers and tell them how to use the devices safely."

Louisiana legislators are also concerned. They asked their environmental agency to study the 5G safety issues. The problem, Moskowitz says, is that "there are no health studies" specifically on exposure to 5G.

Richard Blumenthal, senator from Connecticut, shares their concerns. At a February 2019 Commerce Committee hearing on 5G, he blasted the FCC and FDA for "failing to conduct research into the safety of 5G technology . . . instead, deferring to industry. We're flying blind here."

Dozens of cities, including Huntington Beach, California; Seattle; and Montgomery County, Maryland, sued the FCC, which they claim has usurped local control in order to promote 5G. They argued that local governments should be able to stop companies from installing thousands of 5G antennas and require that environmental impact studies be made

before the companies move forward. But the FCC issued an order to “remove these regulatory barriers.” And it won.

The Environmental Health Trust also took the FCC to court: “The FCC refused to update U.S. radiation guidelines, ignoring the vast number of studies that found harm from low-level radiation emitted by wireless devices and cell towers,” the EHT’s Scarato explains.

The FCC fought back, insisting its 1996 regulations were still adequate. It also repeated its mantra, that 5G will unleash “a wave of entrepreneurship and economic opportunity . . . helping ensure the U.S. wins the global race to 5G.” However, in 2019, the District of Columbia Circuit Court of Appeals [said](#) the FCC could not eliminate environmental reviews of 5G small-cell infrastructure.

Oral arguments in the EHT case are scheduled for this coming January, but in the meantime, the FCC and telecom companies are forging ahead: the FCC says it can do this—despite local pushback—because the Telecommunications Act of 1996 gives the FCC the sole power to set radiation exposure limits.

Even before the 5G conflict, U.S. cities challenged the industry. In 2010, a San Francisco law required cellphone vendors to warn users about the devices’ radiation and limit their children’s use. CTIA, the trade group, promptly sued, claiming the law violated the sellers’ free speech rights. To flex its economic muscle, CTIA moved its trade show from San Francisco to San Diego. After a three-year fight, the city lost the case in a federal appeals court and backed off—citing the risk of having to pay the industry’s legal fees.

Five years later, Berkeley passed a more limited law that required vendors to educate users about the safety issues. CTIA sued again, arguing it

“violated the sellers’ first amendment rights.” At first, the Circuit Court sided with Berkeley and some vendors complied. But CTIA appealed the decision, arguing that the Berkeley ordinance “over-warned the consumer.” Also, the FCC weighed in that Berkeley didn’t have the right to inform the public about safety concerns because the FCC gave the public all the data it needed. This time, [Berkeley lost](#).

Scarato [notes](#) that Thomas Johnson Jr., the FCC’s general counsel for the Berkeley case, was previously at the law firm of Gibson, Dunn and Crutcher, which represented the CTIA when it sued Berkeley.

How users can limit their exposure

Since wireless devices are here to stay (5.2 billion people use them globally), scientists and health advocates say the best course is to limit people’s exposure. To this end, California’s Department of Public Health says people should use headsets but remove them when not talking, since they release small amounts of radiation even when not in use. Also, they should text instead of talk; carry phones away from their bodies (in backpacks, briefcases, handbags, and tote bags); keep them away from their heads when streaming; and download movies (instead of streaming).

Alasdair Philips, the U.K. scientist, says that modern cellphones use less power and thus emit less radiation than cordless phones (also called satellite phones). But he stresses they are still hazardous and should only be used in areas where reception is strong. Just as important, Philips says, “You should download material, rather than stream it, since streaming emits more radiation. And you should not use ear buds, since these fit deeply inside the ear.”

Warnings from industry executives such as Frank Clegg (Microsoft Canada’s former CEO) are rare. So, too, are those from governments, since

the industry lavishes huge sums on the lawmakers. According to the Center for Responsive Politics, from 1989 to 2017, the industry gave \$101 million to members of Congress and their PACs. Its favorites were Senator John McCain (R-Ariz.), \$2.5 million; Rep. Ed Markey (D-Mass.), \$1.7 million; Rep. Greg Walden (R-Ore.), \$1.6 million; Rep. Fred Upton (R-Mich.), \$1.6million; and Rep. Steny Hoyer (D-Md.), \$1.4 million. The [three most generous donors](#) were AT&T (\$19.8 million), Comcast (\$14.9 million), and Verizon (\$11.2 million). Moreover, the National Institute on Money in Politics says industry lobbying groups plowed \$93.7 million into local elections in 2018.

As expected, the largesse continues to be rewarded, and a misinformed public continues its love affair with all things wireless.

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<https://washingtonspectator.org/wireless-hazards/>

5G, Your Health And The Environment

WHAT IS 5G?

5G is the fifth generation of wireless technology promising to connect the Internet of Things (IoT) at blazing fast speeds. Millions of new cell antennas are being installed in front of homes on street lights and utility poles. Telecom has heavily lobbied governments to pass new regulations that fast track new wireless antenna installations by removing public notice and public hearings and usurp local control.

Issues With 5G

- Experimental technology
- Increases radiation exposure
- Outdated radiation guidelines
- Children are more vulnerable
- Inadequate regulations
- Impact to tree canopy
- No oversight by health authority
- No environmental review
- Increases energy usage
- Increases e-waste and pollution
- Lowers property values
- Local authority overruled
- Loss of privacy
- Interferes with weather forecasting
- Screen addiction
- Uninsured liability
- Cyber security risks

Peer Reviewed Research On Wireless Radiation

- Sperm damage
- Oxidative stress
- Altered brain development
- DNA damage
- Immune system damage
- Memory problems
- Sleep problems
- Hyperactivity
- Behavior problems
- Breach of blood-brain barrier
- Brain tumors
- Cancer
- Harm to birds, bees, and trees

Harvard Investigation Finds Industry Funding Influences Science and Policy

"Industry control, in the case of wireless health issues, extends beyond Congress and regulators to basic scientific research."

— Norm Alster, in *Captured Agency*, Harvard University

Medical Doctors Caution:

"An Egyptian study confirmed concerns that living nearby mobile phone base stations increased the risk for developing headaches, memory problems, dizziness, depression and sleep problems. In large studies, an association has been observed between symptoms and exposure to these fields in the everyday environment."

— *The American Academy of Pediatrics*

Scientists Worldwide Are Calling For A Halt To 5G:

"We recommend a moratorium on the roll-out of the fifth generation, 5G, for telecommunication until potential hazards for human health and the environment have been fully investigated by scientists independent from industry...RF-EMF has been proven to be harmful for humans and the environment."

— *The 5G Appeal (signed by over 250 independent scientists and medical doctors from 40 countries)*

Worldwide Opposition

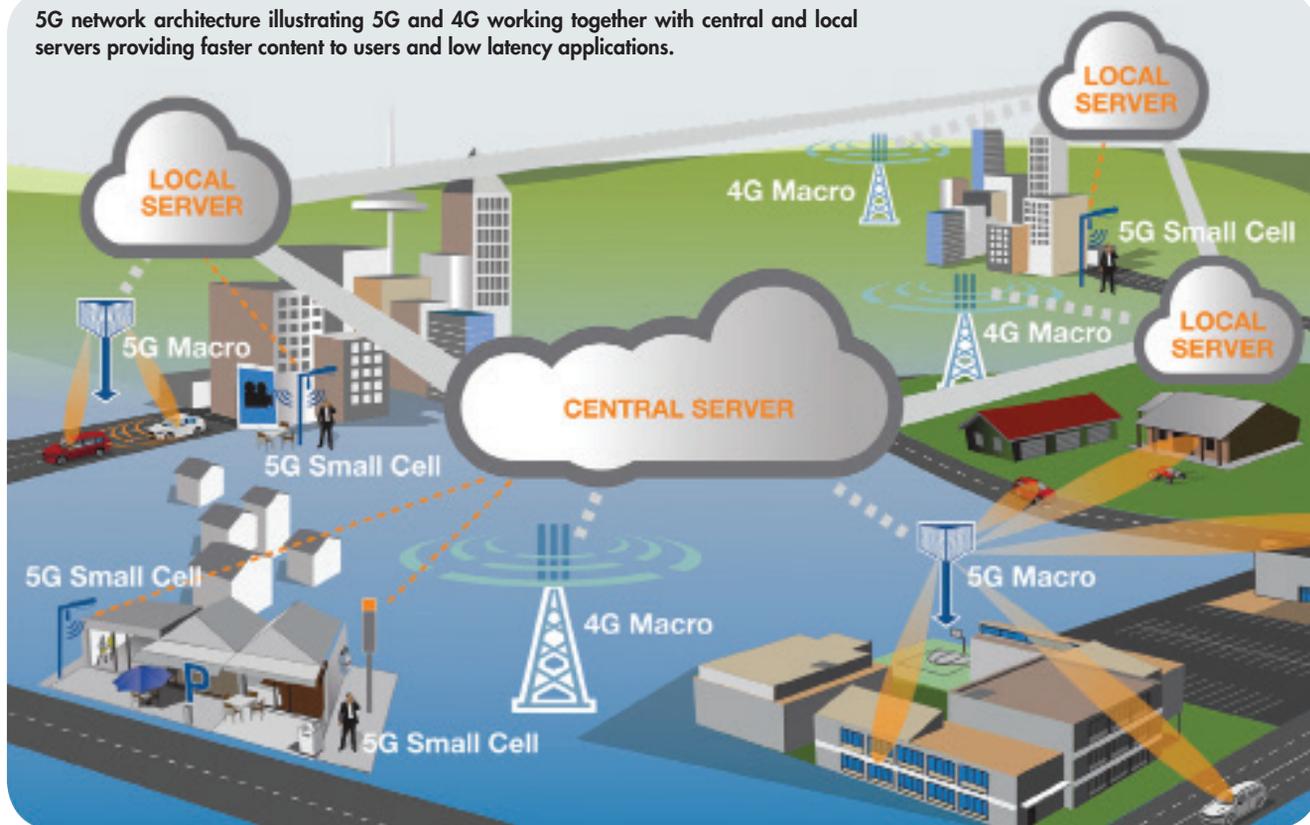
Governments are taking action to stop 5G. Dozens of cities in Italy, the U.K., the U.S. and Switzerland are passing resolutions/restrictions to halt the 5G roll-out until adequate safety testing has been done. Several countries recommend reducing children's exposures to cellular phone radiation.



5G and electromagnetic fields

With more bandwidth, EMFs become stronger.

5G network architecture illustrating 5G and 4G working together with central and local servers providing faster content to users and low latency applications.



**By Owen Davies
Contributing Writer**

Recently, we tried to cut through the babble about 5G, look at actual data, and figure out how troublesome it really is for aviation. See *Pro Pilot*, April 2022, page 8. Since then, the Federal Communications Commission (FCC) has doubled down on blaming its victims, ordering avionics makers to bring their “defective” radar altimeters up to a standard of signal discrimination required in no other country.

However, that is not our topic here. This time, we will look at what electromagnetic fields (EMFs) may be doing – not to your equipment, but to you.

Why EMFs matters

Many hundreds of scientific studies have linked radiofrequency EMFs

to serious medical issues. They include DNA damage, rare brain cancers, including glioma and acoustic neuroma, salivary tumors, heart disease, diabetes, sperm abnormalities, reduced volumes of the brain’s gray matter and damaged white matter, neuropsychiatric disorders such as anxiety and depression, and even very early onset Alzheimer’s disease. The list seems to grow almost daily.

This may be significant to pilots. Nina Anderson, a retired corporate pilot who has built a second career as a respected consultant specializing in EMF issues, reports that jet cockpits are the most EMF-dense environment she has ever examined. Every flight instrument and radio contributes its share.

We should note that all findings of a link between EMFs and health are disputed. For every study showing that electromagnetic fields subvert biological systems, scientists funded

by the telecommunications industry can provide one to refute it, plus an explanation of why the other research was methodologically flawed or otherwise invalid. They do so routinely.

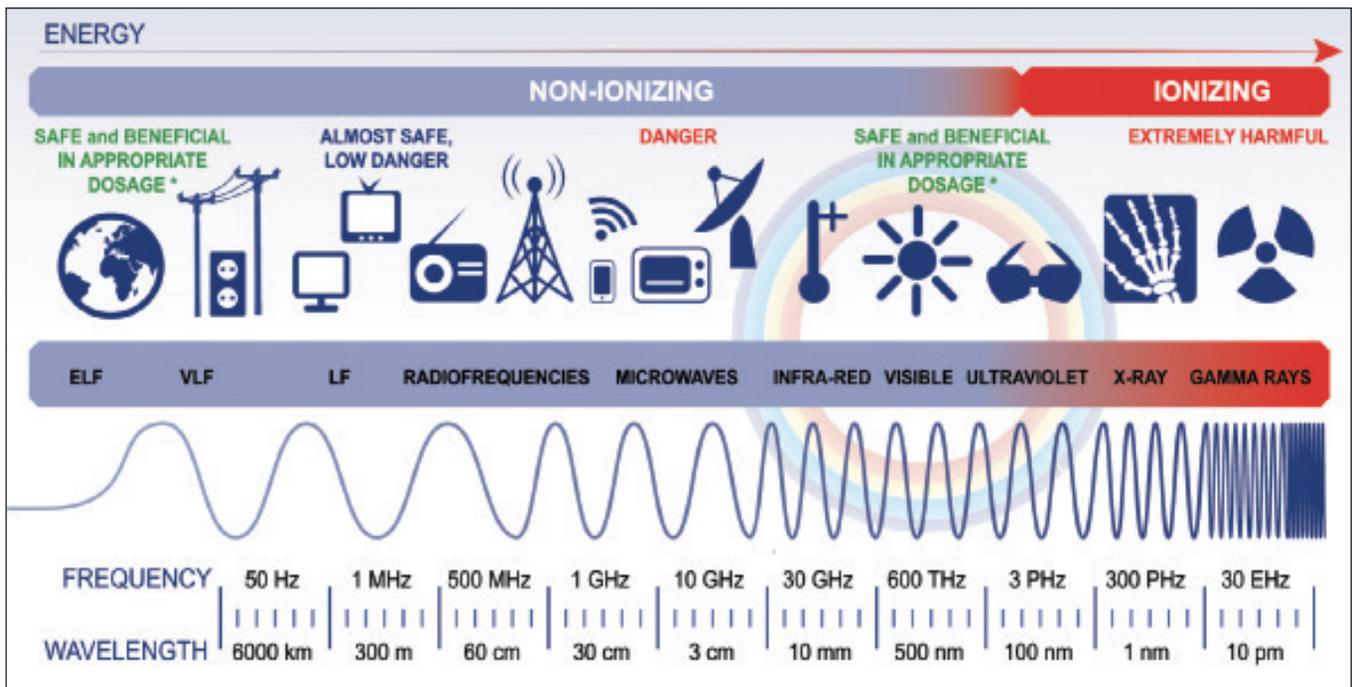
Anderson has little sympathy for them. A similarity to the tobacco industry may have been mentioned.

Nonetheless, since the 1990s, the great preponderance of independent evidence has shown that exposure to EMFs has medical consequences. A lot more supporting data has been added since then.

What has changed

Nature exposes all life to EMFs. Most forms are weak, and distributed over a wide range of frequencies. The sun’s ultraviolet light causes burns and skin cancers, and contributes to skin aging. As far as we know, natural EMFs otherwise are harmless.

Technology is different. The EMFs



our artifacts create are stronger than most natural fields, and we marinate in them 24/7. Their frequencies often are well-suited to couple with biological processes. They're also polarized, where natural EMFs are not. This can greatly amplify their biological effects.

EMF sources abound in our homes and workplaces – even on the street. Wifi, Bluetooth devices, computers, microwave ovens, “smart” electric meters, and the inverters that turn DC electricity from solar panels to 120V AC all generate EMFs at varying frequencies and power. A single fluorescent light can add high-frequency voltage spikes to electricity that arrived “clean.” Turn off all these devices, and we still would receive EMFs from our neighbors – especially in apartments – and when passing cellphone towers.

In the years ahead, we will experience even more EMFs. Devices connected to the “internet of things” pass data and control signals back and forth wirelessly almost constantly. Estimates vary, but they could be 30 to 50 billion of them by 2025. In time, their “electrosmog” will fill the air as London’s pea-soup fogs did in the age of coal.

Why 5G matters

Cellphones are a particular concern because they broadcast next to our ears at frequencies that in recent generations can extend into the

microwave range. And in all but the most rural areas, tower transmissions are with us always.

Each new generation of phones carries more data faster than the last by transmitting at higher frequencies. 4G phones, for example, operate at 2.5 GHz microwave frequencies. 5G extends to 39 GHz. And generations up to 8G already are under development.

The good news is that the electrical component of high-frequency EMFs penetrates barely 1 mm into the body. The bad is that it couples to biological processes much more efficiently than phone transmissions used to, and nothing keeps their magnetic component at bay.

There is more. Buildings block 5G signals, so many more transmitters are needed to serve an urban area. They also use beam forming to aim all their power in one direction rather than omnidirectionally, as previous cell technologies have done. Standing in a 5G beam at a given distance subjects us to much more powerful electromagnetic radiation than 4G did, and because there are more transmitters, we have more opportunity for exposure.

Telecoms point out that no one has ever shown 5G transmissions harm human health, and this is true. The technology is so new that no one has had time to carry out the necessary studies. Yet, even for 4G, the data is compelling. As long ago as 2009, neurosurgeon Vini G Khurana at the

Australian National University, and colleagues in Australia, Austria, and Sweden, reviewed long-term epidemiologic studies of cell phones and brain cancer. They found that using a cell phone for 10 years or more doubled the risk of glioma and acoustic neuroma, but only on the side of the head where users held their phones.

In Malta, researchers studied the incidence of glioblastoma multiforme, the rare brain cancer scientists have long suspected might be linked to the use of cell phones. From 2008 through 2017, the number of people who had used cell phones for 10 years or more, when excess cancers are considered most likely to appear, was rising fast. Medical records showed an obvious trend. In 2008, there were only 0.73 cases per 100,000 population. Ten years later, there were 4.49 per 100,000. Something might have caused this other than the growing use of cell phones, but no credible alternative has been suggested.

Moreover, researchers at the Yale School of Public Health reported in 2020 on genetic variations that predispose people to develop thyroid cancer. Heavy cell phone use more than doubled the risk of thyroid cancer in those with any of four such variations.

Professional critics can find ways to trash any inconvenient research. For the rest of us, the picture should be clear.

The bottom Line

EMFs can affect us in ways that are especially important in the air. Known effects that appear within the duration of an average flight include fatigue, irritability, an inability to concentrate, and mild cognitive impairment resulting in task saturation, mistaken priorities, complacency, and spatial disorientation.

Between 1993 and 2013, US Air Force pilots were involved in 72 severe accidents attributed to spatial disorientation. The incidents resulted in 101 deaths and 65 aircraft lost. The possibility that electromagnetic fields were to blame concerned the Defense Advanced Research Projects Agency (DARPA) enough that in October 2020 it initiated a 2-year project called Impact of Cockpit Electro-Magnetics on Aircrew Neurology (ICEMAN).

ICEMAN appears to have been dormant for some 20 months, but in May DARPA issued a \$371,000 grant to Spotlight Labs, specialists in human factors analytics in Haddonfield NJ, and Norwich University in Vermont. Engineers there will use 5 workstations to simulate EMF in the cockpit of an F-16 and identify any effects on experienced F-16 pilots. ICEMAN has \$1.5 million in total funding and is scheduled to last 3 years.

A hint of what ICEMAN could find comes from the International Association of Fire Fighters. As early as 2004, the organization published a resolution stating that it did not want telecom infrastructure located near fire stations. The issue came up when fire fighters in Santa Barbara responding to emergencies could not remember such basic information as where they were going or how to administer CPR. The problem affected those operating from stations with cell towers nearby. According to Dr Gunnar Heuser, now retired from the UCLA Medical Center Department of Medicine, brain scans showed changes in their gray and white matter.

Looking ahead

Regulators and advisory bodies have been remarkably unmoved by all this evidence. A few decades ago, the only known hazard of radio frequency (RF) signals was excessive heating: when powerful enough, RF can warm tissues like a microwave



F-16 cockpit xxxxxxxxxxxxxxxxxxxx xxxxxxxx
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oven. Emissions were known to cause corneal damage in this way, and FCC regulations were designed to prevent that kind of injury. They have remained unchanged since 1977. Independent researchers say they are 10 to 100 times higher than they should be.

The official positions of nearly all regulators and medical bodies match that of the telecom industry exactly. FCC, FDA, and even the National Cancer Institute declare, in FCC's words, "At relatively low levels of exposure to RF radiation, ie, levels lower than those that would produce significant heating, the evidence for production of harmful biological effects is ambiguous and unproven." The World Health Organization (WHO) concurs. Yet, one government body does not. In 2019, the New Hampshire state legislature created a commission to study the environmental and health effects of evolving 5G technology. It reported in November 2020 that 5G signals unambiguously couple with biological processes in ways that caused health problems. It also concluded that regulators and advisory bodies had been captured by the telecoms they were supposed to police. They had cause to believe it.

The picture is clearest at WHO

The guidelines most European governments rely on for EMF standards come from the International Commission on Non-Ionizing Radiation Protection (ICNIRP) – a private non-governmental organization based in Germany. In practice, it is tightly bound to both WHO and the telecom industry.

ICNIRP was founded in 1992. Its first chairman was Australian biophysicist Michael Repacholi. He had no background in EMF research, and he immediately adopted the idea that only heating injury matters. Four years later, he became founding chairman of the WHO EMF Project and established the same policy there. Despite what might seem a conflict of interest, he held both offices simultaneously.

His chosen successor at WHO was Emilie van Deventer, an electrical engineer from the University of Toronto praised by the university magazine for her "invaluable" service to the telecom industry. It brought in donations and lucrative research contracts. She received research funding from the Natural Sciences & Engineering Research Council of Canada, Communications & Information Technology Ontario, and Nortel, then Canada's largest telecommunications company. Deventer took office in 2008 and remains head of the EMF Project today.

The EMF Project is WHO's sole authority on electromagnetic radiation. It established the organization's current policy in a 2016 monograph. The 6-member core group in charge of writing it had only 1 independent member. The rest belonged to ICNIRP and many to other industry groups. Their rejection of non-thermal risks from EMF remains unchanged.

Similar – although less obvious – influences can be found at most regulatory bodies concerned with EMF. In the US, of course, we also have congressmen to run interference for donors companies. Their interest in tightening regulations is, at best, inconspicuous.

In all, anyone concerned about the possible health risks of EMFs will have to protect themselves. How that can be accomplished in the cockpit is not obvious.

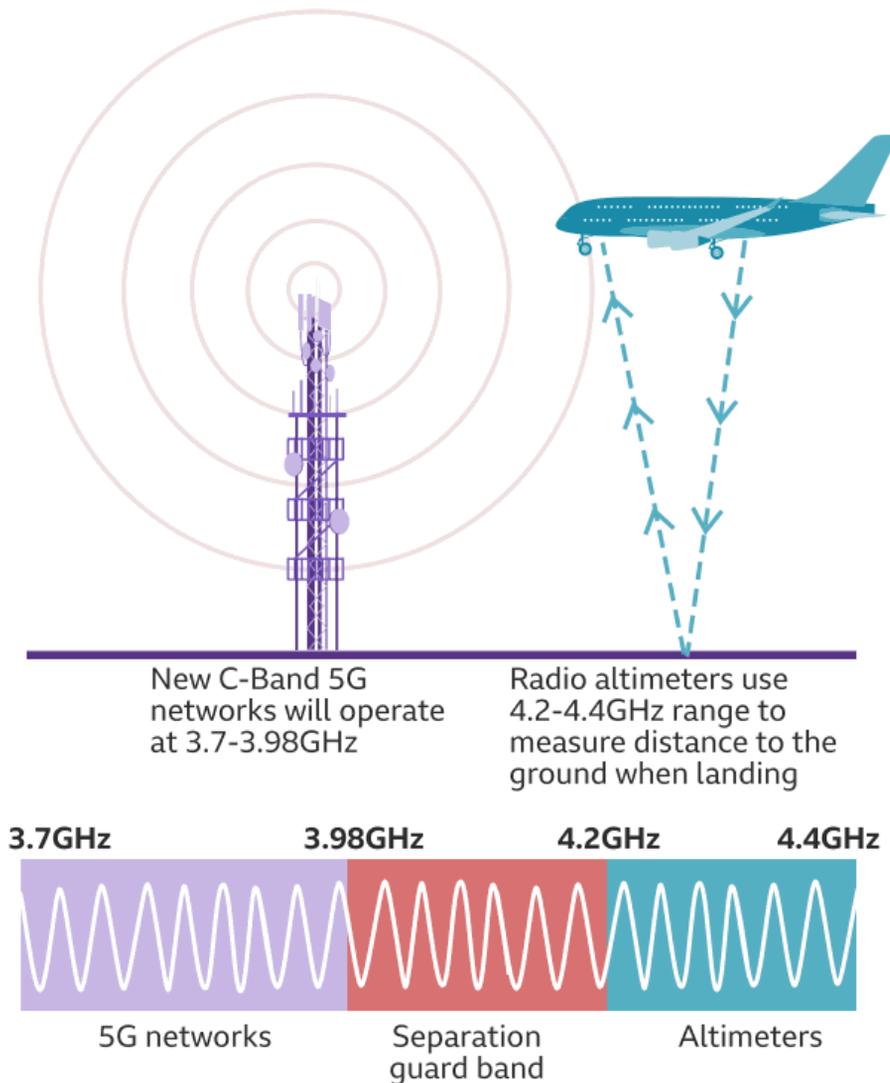
If you are interested in more information about EMFs, it can be found at the Scientific Alliance for Education (www.safehelpsyou.org). ✈



Owen Davies is a veteran freelance writer specializing in technology. He has been a futurist at Forecasting International and TechCast Global.



New 5G spectrum in US faces resistance from aviation industry



Source: Federal Communications Commission, Federal Aviation Administration 1437



EHT Shareable Resources

Cell Phone Radiation

50% of radiation from your cell phone can be absorbed into the head and body.

Specific Absorption Rate (SAR)
SAR is a measure of the rate at which microwave radio frequency radiation (RFR) from wireless devices is absorbed by head and body tissues when held near the body. SAR values are units of watts per kilogram.

SAR LIMITS*
The FCC has set limits for the SAR of mobile phones. The SAR limit for mobile phones is 1.6 W/kg for the head and torso, and 0.08 W/kg for the hand.

Cell Phones are tested at a distance from the body.
When phones come on the market, SAR tests use a distance between the phone and body. Phones are not tested in daily contact positions. As phones melt us to keep a distance.

***Every phone at least 18 inches from your body.**
Apple iPhone 7

THE AMERICAN ACADEMY OF PEDIATRICS RECOMMENDS ...

"Make only short or essential calls on cell phones." - AAP

"If you plan to watch a movie on your device, download it first, then switch to airplane mode while you watch in order to avoid unnecessary radiation exposure." - AAP

DID YOU KNOW ...

A CELL PHONE IN YOUR POCKET EXPOSES THE FAMILY JEWELS TO RADIATION

Peer reviewed research indicates that cell phone radiation damages sperm. Keep your cell phone out of your pants and pockets.

EHTrust.org #PracticeSafeTech

DID YOU KNOW ...

WIRELESS DEVICES EMIT RADIATION 24/7

Corded connections do not emit radiation. Disable all wireless transmitters when not in use, particularly when handling a device to a child. Set Airplane Mode ON with Wi-Fi OFF & Bluetooth OFF.

EHTrust.org #PracticeSafeTech

SOCIAL MEDIA GRAPHICS For Spreading Awareness >

EHT'S CELL PHONE RADIATION AND HEALTH INFOGRAPHIC Download infographic >

What You Need to Know About 5G Wireless and "Small" Cells

"We recommend a moratorium on the roll-out of the fifth generation, 5G, for telecommunication until potential hazards for human health and the environment have been fully investigated by scientists independent from industry. 5G EMF has been proven to be harmful for humans and the environment." — 2017 SC Scientific Appeal (signed by more than 100 scientists and doctors from 35 countries)

Nationwide, communities are being told by wireless companies that it is necessary to build "small cell" wireless facilities to enable 5G services and to improve network capacity. At the local, state, and federal level, new legislation and new funding aim to streamline the installation of these "small cell" antennas in public rights-of-way.

The radiation from small cells is not small. Wireless antennas emit microwaves — non-ionizing radiofrequency radiation — and essentially function as cell towers. Radiation emitted from small cells is expected to typically travel from 30 feet up to several hundred feet.

Millions of small cells to be built in front yards. The Federal Communications Commission estimates that millions of these wireless antennas will be built in front yards, directly in front of our homes.

5G will add to — not replace — our current wireless technology. 5G will add another layer of wireless radiation to our environment. 5G will not only utilize wireless frequencies already in use but also add in higher frequencies — submillimeter and millimeter waves — in order to transmit data at rapid speeds.

Community authority is overruled. Communities are being deprived of their right to make decisions about this new technology. "Streamlining" means almost automatic approval. Public notice and public hearings are being eliminated. Even if every homeowner on the block opposes the antenna on their street, the approval will be disregarded.

Scientific workbooks are calling for a halt to the 5G rollout. In 2017, over 100 scientists and doctors issued a declaration calling for a moratorium on the increase of 5G antennas citing human health effects and impact to wildlife.

Read the 2017 Scientific Appeal on 5G to the European Commission
Read the 2017 SC Scientific Appeal to the United States
Read Letters From Doctors of Scientists on Health Risks of 5G

Continuing daily radiation exposure poses serious public health risks. Peer reviewed, published science indicates that exposure to wireless radiation can increase cancer risk and alter brain development and damage sperm. Most people are unaware that wireless technology was never tested for long term safety, that children are more vulnerable, and that the accumulated scientific evidence shows harm.

Increased property values. Studies show property values drop up to 20% on homes near cell towers. Would you buy a home with a cell tower in the yard? Research shows that property values drop up to 20% on homes near cell towers.

Microwave antennas in front yards present several worker and public safety issues. Studies have already found comments that workers were injured, someone they were working near transmitting antennas. How will 5G workers, window washers, and tree cutters be protected? The heavy lifting equipment operators involved in putting up antennas also present new hazards. Cars run into utility poles, often, what then?

There is a safer alternative. Worldwide, many regions invest in safer and smarter fiber optic cabling all the way to each home, rather than antennas in front yards. Wind, seismic connections are safe, cause more reliable, provide greater capacity, and are more cyber-secure.

www.ehtrust.org

All text in this document is blue is hyperlinked to resources for more information. Please also see <https://www.ehtrust.org/5g-what-you-need-to-know> for additional resources.

5G, SMALL CELLS AND MICROCELLS FACTSHEETS EHT's factsheets on 5G are used nationally and internationally as an invaluable key resource in educating the public and policymakers on 5G.

NEWSLETTERS EHT's newsletters filled with the latest science and news are shared worldwide with an ever growing list of subscribers. Sign up >

Protect yourself. #PracticeSafeTech

CELL PHONES AND OTHER WIRELESS DEVICES EMIT MICROWAVE RADIATION THAT DAMAGES SPERM AND THE TISSUE OF THE TESTES. DO NOT CARRY DEVICES IN YOUR POCKETS OR ON YOUR BODY.

Protect yourself. #PracticeSafeTech

Protect the ones you love.

PROTECT THE ONES YOU LOVE POSTCARDS

EHT's safety postcards have been widely distributed at health festivals, educational presentations, and scientific conferences. EHT has developed colorful postcards: for parents about the American Academy of Pediatrics recommendations, for young adults who sleep with their phones, for men regarding phones in pockets and for women to make the bra a no-phone zone.

RESOURCES IN SPANISH

"How to Reduce Cell Phone Radiation." Hotbook Magazine from Mexico featured "How to Reduce Cell Phone Radiation Tips" after Dr. Davis and EHT provide resources to one of Mexico's top Travel & lifestyle magazines.

EHT has translated several postcards into Spanish and is increasing our translated resources. See EHT's webpage on Spanish information. After contact with an Italian organization that translated the Catalyst documentary, EHT developed a page on Italian resources as well. EHT plans to create pages in French, and Greek next year.

Do's and Don'ts for Safe Technology

Technology	Do's	Don'ts
Cell Phones	<ul style="list-style-type: none"> Use a speakerphone or earpiece headset. Turn your phone off if you need to put a phone in your pocket. Choose a wired phone when you can, especially for long calls. Cell phones made in the U.S. with SAR labels are safer. Power off cell phones in a car, bus, train, airplane, elevator. 	<ul style="list-style-type: none"> When using the phone, never touch your head or body with the phone. Don't use a cell phone when the network signal is weak, because that the radiation from the phone is higher. Don't carry a cell phone in your line. Don't carry a cell phone in your clothing pocket. Don't sleep with a cell phone or tablet or any wireless electronics near your head.
Home Phones	<ul style="list-style-type: none"> Get a Cordless Phone for your home. Keep your landline. But turn it off if the room where you need a phone is not used. Use a wired VoIP system. 	<ul style="list-style-type: none"> Do not use a cordless home phone. The DECT phone base constantly emit microwave radiation. Many models have three leads directly inside their base, and this is a significant source of microwave radiation to be received from across the room. Don't place a wireless phone in your office near your work area. Wireless phones constantly emit microwave radiation and should not be located near your head per the manufacturer's instructions. Don't use wireless cordless laptops if alternate is available. Don't use laptops on your lap. Don't forget to turn the wifi connection off when you are not using it.

What Parents Need to Know About Safe Technology

Parents should not panic over the latest research, but can be sure as a good reminder to limit both children's screen time and exposure from cell phones and other devices emitting radiofrequency electromagnetic fields (EMF).

The American Academy of Pediatrics Recommendations About Cell Phones, Cell Towers and Wireless

The American Academy of Pediatrics (AAP), the largest U.S. medical association of pediatricians and pediatric specialists, recommends that the U.S. government tighten wireless exposure limits and that the public reduce children's exposure to cell phones and other devices that emit wireless radiation.

In 2016, the AAP issued a press release about the U.S. National Toxicology Program research findings of cancerous tumors found in rats exposed to cell phone radiation. The Academy's website, HealthyChildren.org, that publicly issued new recommendations to reduce children's exposure to wireless radiation.

In 2016, the National Institute of Environmental Health Sciences, National Toxicology Program released findings of increased brain tumors (gliomas), increased adenomas of the heart and increased DNA damage in rats exposed to cell phone radiation.

Wireless radiation during pregnancy has been linked to neurological and developmental abnormalities in the offspring. In 2017, research from the National Institute of Environmental Health Sciences found that increased prenatal exposure to wireless radiation during pregnancy was associated with increased risk of brain tumors in offspring.

Wireless radiation at very low levels has been shown to alter brain activity. In 2017, research from the National Institute of Environmental Health Sciences found that brain glucose metabolism decreased from cell phone radiation.

A 2011 Yale Medicine study found increased hyperactivity and memory problems after prenatal exposure. New Harvard and Yale Doctors are recommending pregnant women reduce exposure. See ehtrust.org

FACT SHEETS

We also have created Safe Tech Do's and Don'ts, factsheets on 5G, cell phone radiation, wireless and "What Parents Need to Know About Safe Technology".

TIPS PARA USAR TU CELULAR DE FORMA SANA

¡Salvemos a los Jóvenes! #PracticeSafeTech

¡Salvemos a las Mujeres! #PracticeSafeTech



Submission of critical environmental justice issues regarding radiofrequency (RF) be it from, 5G, 4G cell phones and Wi-Fi. Any scorecard on EJ should include metrics on cell tower radiation.

For example;

- What are the RF levels in the community? Who is monitoring? What health surveillance is being done?
- Are wireless networks being used to solve the community challenge?
- Are people being informed of their exposures?
- What transparency issues are there?
- Are people a part of the decision making process regain wireless antennas in their community ?
- What about renters and those in HUD where antennas are being put on roof tops?
- When RF technology is brought into schools “to bridge the digital divide”, who is ensuring safety for children? What Metrics?
- What federal health agency is monitoring the science on cell tower radiation health effects to ensure safety? What health agency has reviewed the issue of long term exposure (hint.. none)
- Will 5G and new networks increase energy use? Where are the evaluations of carbon footprint for new networks when they are proposed.



Wireless is an Environmental Justice Issue

EMFs are an environmental exposure, unregulated by federal agencies.

Higher Environmental Levels of Radiofrequency Radiation

Environmental Health Trust ehtrust.org

- Urban areas have more people and more smartphones, as well as more cell towers. The higher density of wireless networks (including more wireless antennas and base stations) results in higher levels of environmental radiofrequency radiation levels.
- Cell towers have been found to be more often placed on schools in lower income areas. Wealthy communities have access to more education on this issue, and often immediately organize in order to halt proposed cell towers at schools.
- Low income families and renters have less ability to move/mitigate exposures.

Higher toxic exposures

- Research shows synergistic effects between EMFs and other toxic exposures. As Black and Brown communities are disproportionately impacted by toxic environmental exposures, they will be even more at risk from these combined exposures.
 - Numerous research studies indicate a synergistic effects between non-ionizing radiation and other toxic environmental exposures. A Jacobs University study ([Lerchl et al 2015](#)) replicated research showing that carcinogen-induced tumor rates were significantly higher in animals exposed weak levels of cell phone radiation. The Ramazzi Institute's studies of rats exposed to formaldehyde ([Soffritti et al., 2016](#)) or low-dose γ radiation ([Soffritti et al., 2016](#)) found EMF exposure significantly increased tumors.
 - Research investigating the impact of lead levels combined with cell phone radiation found an association between mobile phone use and Attention Deficit Hyperactivity symptoms ([Byun 2013](#)) A 2017 study with 1198 mother-child pairs suggested a potential combined effect of prenatal exposure to lead and mobile phone use ([Choi 2017](#)). Research on 2.45 GHz radio frequency - the frequency used in WiFi networks- in combination with carbon black ([Sueiro-Benavides et al. 2020](#)) concluded that "our results indicate that the interaction of BC and RF modifies macrophage immune response, activates apoptosis, and accelerates cell toxicity, by which it can activate the induction of hypersensitivity reactions and autoimmune disorders." [Ansarihadipour and Bayatiani \(2016\)](#) found lead contamination in the presence of a non ionizing EMF field exacerbated the oxidative damage to plasma proteins in blood.
 - Toxic exposures could be potentiated by non ionizing EMFs because of impacts to blood brain permeability. [Poullietier de Gannes et al., 2017](#), [Nittby 2009](#), [Nittby 2008](#), [Eberhardt 2008](#), [Persson 2008](#), [Salford 2003](#) have reported increased blood-brain barrier permeability after exposure to EMF. [Tang 2015](#) published in the journal Brain Research found a 900 MHz field causes blood-brain barrier damage and cognitive impairment in rats using exposures that ICNIRP based regulatory limits would assume cannot cause harm.

- A 2021 review ([Lai 2021](#)) on genetic damage found EMF can interact with other entities and synergistically cause genetic effects. Researchers at the Georgia Institute of Technology and Institute for Defense Analyses ([Kostoff and Lau 2017](#)) have published summaries of the the body of research showing synergistic effects between non ionizing radiation and other agents.

Financial inequity limits ability to reduce environmental and personal exposures

- Private schools will get private funding to install wired networks and reduce RF exposures.
- While often wealthier, educated families are informed and can recommend their children to decrease exposure (like “keep the phone away from your brain”) and have the financial means to purchase adapters and hardwire computers, people with less financial means receive less education on the impacts of wireless radiation, and are often do not have the resources to learn more, speak up, or object. Even when families in under-resourced communities become aware, they do not have the money to buy the hardware needed for safer technology and lack the resources to fully implement RF reduction strategies. Many families are struggling just to get any internet access at all, and are not in a privileged position to choose wired technologies over wireless in their home.

Networks Often Tested in Urban Areas/Schools

- Schools in low income areas are used as test beds for the industry to try out new wireless products such as 5G and virtual reality, despite no research indicating it will support academic achievement of the students, and there being no proof of safety with [accumulating science](#) showing harm. And yet despite being exploited as experimental locations, these are the same communities that lack access to basic connectivity when they do need it. The needs of these communities are ignored and dismissed by the industry’s agenda for experimentation and profit.
- Urban areas are often 5G Test Cities.
- New “high tech” networks and systems that create non ionizing exposures are used for “security” purposes despite the lack of safety data. For example [several schools](#) are using a [technology](#) called [evolve](#) so students do not have to wait in line to go through metal detectors or wand checks. “Evolv Express® is an AI-driven system using safe, ultra-low frequency, electromagnetic fields and advanced sensors to detect concealed weapons.”

Occupational Exposures to Pregnant Women are Unmitigated

- As an occupational health issue, many people have limited ability to reduce RFR without risking losing their jobs.

Health care inequalities will further exacerbate health inequities

- Health care inequalities will further exacerbate health inequities as people in under resourced communities will receive unequal care for the damages from exposure to RFR.

- Communities with higher environmental exposures to toxic chemicals, heavy metals (such as lead) and air pollution will have disproportionate impacts from RFR exposure, as [research](#) shows a synergistic effect between EMFs and other toxic agents.
- People of color are 1.5 to 2.0 times [more likely](#) than white people to have most major chronic diseases. (source) Oxidative stress is understood to play a role in the development of many chronic diseases as well as [cancer](#). Research reviews ([Schuermann and Mevissen, 2021](#), [Yakymenko et al. 2016](#)) repeatedly find that non-ionizing EMF exposure can cause oxidative stress by the increase in free radicals.
- Research links non-ionizing radiation with diseases that communities of color already experience higher rates of, such as [obesity](#), [asthma](#) and [diabetes](#). African American women face significantly [higher risks](#) of having a miscarriage, and [replicated research](#) links non- ionizing radiation to increased miscarriage risk.
- Health care inequalities will further exacerbate health inequities as people in under-resourced communities will receive unequal care for the damages from chronic disease caused by or exacerbated by RFR and other non ionizing electromagnetic radiation exposure.

European Parliament requested a research report, [“Health Impact of 5G”](#), released in July 2021, which concluded that commonly used RFR frequencies (450 to 6000 MHz) are probably carcinogenic for humans, and clearly affect male fertility with possible adverse effects on the development of embryos, fetuses and newborns. 5G will [increase](#) ambient levels of wireless radiofrequency radiation ([Mazloum et al., 2019](#), [El Hall and Naus 2020](#)). Peer-reviewed research has demonstrated a myriad of adverse effects from wireless radiofrequency radiation including increased [brain cancer](#), [DNA damage](#), [oxidative stress](#), [immune dysfunction](#), [altered brain development](#), [damaged reproduction](#), [sleep changes](#), [hyperactivity](#), and [memory damage](#). ([MORE RESEARCH HERE](#))

Cell antennas are being put up in front of apartments, and residents who are renters are not being informed, nor are they a part of the decision making process.





5G and the Internet of Things will increase energy consumption and exacerbate climate change

A 2022 review by the University of Sussex Business School entitled “[The energy use implications of 5G: Reviewing whole network operational energy, embodied energy, and indirect effects](#)” published in *Renewable and Sustainable Energy Reviews* finds that the concept that 5G is green technology is not currently supported by a strong, publicly available, fully transparent evidence base. The researchers did a literature review to examine whole network level

assessments of the operational energy use implications of 5G, the embodied energy use associated with 5G, and indirect energy use effects associated with 5G-driven changes in user behaviour and patterns of consumption and production in other sectors of the economy. The authors warn that, “the widespread adoption of unlimited data subscriptions for 5G users and the facilitation of advanced and data-intensive mobile services such as VR and more sophisticated mobile gaming could encourage energy-intensive user practices, contribute to ever-growing levels of data traffic, and counteract the energy-saving potential of 5G efficiency improvements.”

5G requires millions of new cellular antennas called “small cells” —basically shorter cell towers— to be built in neighborhoods *directly in front of our homes*. These 5G antennas are designed to connect with billions of new wirelessly connected “smart” devices referred to as the Internet of Things (IOT).

Wireless companies are well aware that 5G will increase overall energy consumption. David Bruno, an expert in electromagnetic pollution, obtained a document from the National Frequencies Authority (ANFR) concerning the installation of an Orange relay antenna site in Marseille. According to him, “[the colossal power of 5G antennas is to be feared](#)”. He analyzed the Orange document and found the 5G relay antennas in the 3400 to 3800 MHz band will by themselves emit electromagnetic radiation twice as strong as the sum of the relay antennas of 2G, 3G and 4G technologies combined, and in the near future, people living near relay antennas will be exposed to power density levels in W / m² at least 3 times higher than those of today.”

The energy consumption will rise sharply due to the ever increasing IOT energy demands at every stage of the lifecycle of 5G equipment, from device manufacture to data centers to data transmissions, and networks.

- **70.2 million** “small cell” tower bases to be installed by 2025
- **500 billion** devices are expected to be connected to the Internet by 2030
- **8.9 billion** mobile phone subscriptions worldwide by 2024
- **60% growth a year** in production of wireless peripherals (Wi-Fi/ Bluetooth speakers, appliances, wearables)
- **7 fold** increase in mobile data traffic globally projected between 2017 and 2022

In economics, the Jevons Paradox is when technological progress increases the efficiency with which a resource is used, however demand and consumption increase as well. Thus, the end result is overall increased use of the resource, *despite any efficiency gains*. This is a prime example of the Jevons Paradox.

5G will impact tree health contributing to climate change

Trees play a vital role in mitigating climate change, sequestering millions of tons of carbon that would otherwise pollute our climate. The installation of 5G equipment often requires heavy pruning and digging. This will clearly impact the canopy and root systems of our trees.

Numerous news reports document that trees are being felled, heavily trimmed and roots are damaged from the 5G rollout. 5G means millions of new short cell towers *plus* more macro towers— the tall cell towers to tie together the new networks.

In Washington DC, the Sierra Club and numerous tree groups testified to City Councilmembers in opposition of the 5G rollout due to the impact to trees. Who will manage the tree trimming? Who will ensure their protection? [There has been no environmental impact study to determine the impact to trees from the trimming and digging.](#)

In 2020, forty residents and demonstrators gathered at Saint-Cadou in the town of Sizun ([Finistère](#)) to block the installation of a 5G antenna belonging to the Telecom company Free, as loggers were proceeding to fell about twenty trees in the area where the antennas were to be located. [Protesters climbed the trees. Images here. \(Le Télégramme\)](#)

In 2021, [news reports](#) document how a federal judge [denied a request](#) from residents for a temporary restraining order to halt the cutting down of trees to make room for a 95-foot cell tower in New York. Court rulings worldwide have confirmed that internet connections are more valued than trees. Precedent setting cases have ruled that property owners can be forced to trim or remove trees that are blocking their neighbors’ broadband reception. In 2018 Justice Fitzgerald (New Zealand) [ruled that](#) “undue interference with a wifi signal” caused by trees could constitute an “undue interference with the reasonable use and enjoyment” of someone’s land. [Washington DC Sierra Club Testimony](#)

Numerous environmental groups have written letters and appeals on the issue of the unfettered energy consumption and the harm to trees, bees and wildlife. Greenpeace France released a [position on 5G](#) as creating “digital pollution” that will increase carbon emissions, increase e-waste, strip the earth of natural resources and contribute to human tragedies on a global scale. A key environmental group in Spain, [Ecologists in Action](#), issued a [position on 5G](#) calling for precaution and “in view of the deployment of 5G and the transformations that will accompany it, it is inevitable to ask ourselves: what kind of world do we want to live in: a hyper-digitalized, robotized, monitored, controlled and manipulated society, or a society where human relations, care, the common good and democratic debates on key issues for our future take precedence? In other words, what will we put at the center: life or the machine?”

A [Letter from Environmental Working Group To California State Officials](#) states “there is already adequate existing sound science for government to proceed *with caution* on the roll-out of the new technology. In particular, the results of the \$25 million National Toxicology Program

study (2016) that showed tumors in rats caused by a typical amount of heavy cell phone use are to be reckoned with.”

The [Green Party of California](#), the [Sierra Clubs of California](#), [Washington DC](#), [Montgomery County, Maryland](#) and [Montgomery County Maryland 350](#) have taken positions for protecting trees and the environment, as well as addressing the energy consumption of 5G networks.

- [Green Party of California](#)
- [California Sierra Club Letter](#)
- [Washington DC Sierra Club Testimony](#)
- [Montgomery County Maryland Sierra Club Letter](#)
- [Montgomery County Maryland 350 Letter on Small Cell Legislation](#)
- [Ecologists in Action on 5G](#)
- [Letter on small cell streamlining bill from Greenlining Institute](#)
- [Greenpeace France Position on 5G](#)
- [Letter from Environmental Working Group](#)

REPORTS

[High Council for the Climate Report, “Controlling the carbon impact of 5G”\(2020\)](#)

[German Environment Agency 2020 Report, “Fibre optic video transmission is nearly 50 times more efficient than UMTS”](#)

[The Shift Project, “LEAN ICT: TOWARDS DIGITAL SOBRIETY”: OUR NEW REPORT ON THE ENVIRONMENTAL IMPACT OF ICT” \(2019\) PDF Summary](#)

Cell Tower and Small Cell Safety Issues

The cell tower industry has a poor track record for safety, compliance, and people working on towers or buildings are at risk.

- Read [Beware the Dangers from AM Radio and 5G Transmission Sites \(PDF\)](#) published in [Tree Care Industry Magazine](#) January 2021 on the hazards faced by tree care workers in increasing proximity to the ever-expanding universe of antennas, both regular radio and 5G/wireless.
- An [October 2014 Wall Street Journal article](#) reported that “One in 10 sites violates the rules, according to six engineers who examined more than 5,000 sites during safety audits for carriers and local municipalities, underscoring a safety lapse in the network.”
- According to the US Labor Department, the rate of cell tower worker accidents has [sharply risen](#) over the last few years as towers are being built at a rapid pace with minimal regulations and worker safeguards in place . The [Occupational Safety and](#)

[Health Administration \(OSHA\) is currently investigating](#) the “alarming increase in preventable injuries and fatalities at communication tower work sites.”

- [In 2013 the International Brotherhood of Electrical Workers](#) wrote the FCC in 2013 that “ensuring compliance with existing FCC RF human exposure limits by the FCC licensee is not effective and cannot/is not being enforced.” Concerned about the health of their workers and consistent reports of injuries from the lack of enforcement, they state, “When there is a hazard, the hazard creator has a duty to warn others against the hazard.” (Electrical workers are suffering internal injuries from the radiation as they are doing unrelated work but are unaware of a poorly marked antennae closeby. If you stand in front of these radiation beams you will be injured.)
- The EM Radiation Policy Institute wrote the FCC in 2013 with documentation of [Failure to Regulate Antennas and the Lack of FCC Monitoring of Compliance with FCC RF Safety Policies](#) stating that “the FCC does not monitor compliance and does not take any effective enforcement action against violators.” See examples of fires, collapse and accidents [Here](#)

Wireless networks in the workplace pose risks.

People working in retail stores, hospitals, security, transportation, construction, education and food service are increasingly using phones and wireless networks as part of the job. While people in desk jobs may be able to make changes that reduce exposure, many people have no choice in the matter. They are also not being informed by their employer of ways to reduce exposure to the phones and devices they must use at work.

Cell towers are increasingly on school properties, especially in low income areas.

- In Montgomery County, the school cell towers are concentrated at schools with larger populations of people of color and FARM (free and reduced meal) rates ([See Map showing schools with cell towers clustered on the area](#)). Parents in schools with morewhite and affluent populations have organized and swiftly, successfully fought off the same towers.
- For example, this [video of the Wootten High School parent meeting](#) showsparents in a wealthier community (a mostlywhite county) who who stop a cell tower within 24 hours after meeting with the principal. Compare that meeting to how the process unfolds in schools with a more diverse population.

- In contrast to more affluent white communities, parents in lower income communities need to work for months to halt school cell towers that are of concern, and sometimes the tower goes up despite their strong opposition. See a [meeting at Parkland Middle School](#), where the parent leadership and community repeatedly expressed opposition, but the tower kept moving forward. The administrations often ignores opposition in lower income communities, and people are often treated like nuisances rather than stakeholders.

See this video of Greenbelt, MD in Prince George's County (a majority African American county) where [parents in a meeting](#) on cell towers are told "*some of you would never be happy.*"

- Many low income areas lack the community resources to be aware that a cell tower has been proposed. For example, in Prince George's County, some community meetings have had one participant attend the cell tower community meeting, and some PTAs were not notified until after leases for cell towers were already signed. As research shows these towers can decrease property value by up to 20%, cell towers on school grounds change the landscape of the nearby residential community, create stigma and further lower property values.

Most people are not aware that hundreds who have published research in the field of bioelectromagnetics are calling for urgent policy action due to the mounting scientific evidence confirming adverse effects.

- 255 scientists who have published in the field signed the [EMF Scientists Appeal](#) which states, "Numerous recent scientific publications have shown that EMF affects living organisms at levels well below most international and national guidelines. Effects include increased cancer risk, cellular stress, increase in harmful free radicals, genetic damages, structural and functional changes of the reproductive system, learning and memory deficits, neurological disorders, and negative impacts on general well-being in humans. Damage goes well beyond the human race, as there is growing evidence of harmful effects to both plant and animal life."
- 419 scientists and doctors have signed the [European Union 5G Appeal](#), which states, "5G will substantially increase exposure to radiofrequency electromagnetic fields (RF-EMF) on top of the 2G, 3G, 4G, Wi-Fi, etc. for telecommunications already in place. RF-EMF has been proven to be harmful for humans and the environment."
- Over 3,500 medical doctors signed onto a 2020 Consensus statement that wireless RF has been proven to damage biological systems at intensities below government limits ([See signatures here](#), [PDF of Consensus Statement](#)).

- Examples of Numerous Appeals by Medical Professionals: [International Society of Doctors for Environment](#), [Cyprus Medical Association](#), [the Vienna Austrian Medical Chamber and the Cyprus National Committee on Environment and Children’s Health](#), [Belgium Doctors Appeal](#), [Canadian Doctors](#), [Cyprus Medical Association](#), [Physicians of Turin, Italy](#), [the German Doctors Appeal](#), [International Appeal to Stop 5G on Earth and Space](#), [Letter to President Trump](#), [Letter to President Biden](#) and [Chilean Doctors](#). There have been appeals and position statements for decades. [Read a full list here](#).
- Numerous expert reports conclude that safety is not assured.
 - The [New Hampshire State Commission 5G Report](#) has 15 recommendations to protect the public
 - The Pittsburgh Law Review: [The FCC Keeps Letting Me Be: Why Radiofrequency Radiation Standards Have Failed to Keep Up With Technology](#) explains how the FCC and FDA have failed to develop adequate safety limits.
 - The Harvard Press Book “[Captured Agency: How the Federal Communications Commission is Dominated by the Industries it Presumably Regulates](#)” details how wireless companies are using the Big Tobacco playbook and how the FCC is a captured agency.

The challenge is an international one.

“Given that treatment for a single case of brain cancer can cost between \$100,000 for radiation therapy alone and up to \$1 million depending on drug costs, resources to address this illness are already in short supply and not universally available in either developing or developed countries.”

- [Swedish review strengthens grounds for concluding that radiation from cellular and cordless phones is a probable human carcinogen](#)

Appendix

Letter to Montgomery County Council that was not responded to after the county proposed a law to remove public hearings and public notice regarding 5g small cells.

Dear County Councilmembers,

Our organizations recently became aware of the potential climate implications of the Zoning Text Amendment - ZTA 19-07 - Telecommunications Towers - Limited Use.

We are concerned that the increase in the number of 4G and 5G small cell towers in neighborhoods could result in an increase in energy use and greenhouse gas emissions in Montgomery County, as well as a significant reduction in the tree canopy throughout the county. These impacts would prevent the County from achieving our goals identified in the Emergency Climate Mobilization Resolution No. 18-974 to reduce our greenhouse gas emissions by 80% by 2027 and by 100% by 2035. Additionally, we are concerned that these same climate impacts will disproportionately worsen the negative effects on communities of color, people of low income and other vulnerable households in the County. See the [list of studies and reports](#) identifying these outcomes and concerns.

Section G-8 of the County's Climate Action Plan, which is entitled *Evaluate and Update County Planning, Policy, and Operations Activities to Reduce Greenhouse Gases* states that "Climate-related contracts should require equity-enhancing measures that proactively engage and improve the socioeconomic conditions of communities disproportionately impacted by systemic inequities such as low income, race, and/or immigration status, and communities considered most vulnerable to the impacts of climate change. This action also includes establishment of a climate impact statement to evaluate all pending bills, budgets, plans and land use decisions."

As a result, before any vote on ZTA 19-07 takes place, we ask the County Council to provide both a climate impact statement and a racial equity and social justice statement on the implications of this proposed ZTA.

Additionally, we ask that you support County Executive Marc Elrich's proposal on June 29, 2021 to convene a working group comprised of a diverse group of stakeholders, including industry, residents, municipalities and homeowner/tenant associations, non-profit organizations and executive and council staff for a limited time, perhaps 75 - 90 days, to allow for the opportunity for a more complete discussion of the issues after which their recommendations can be presented to the Council.

We appreciate your consideration of these requests. We look forward to hearing from you very soon.

Best regards,

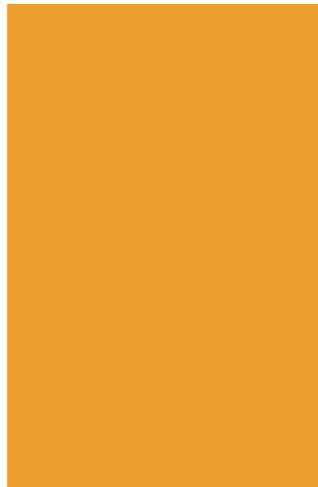
350.org MoCo

Environmental Health Trust ehtrust.org

Bethesda Green
Biodiversity for a Livable Climate
Cedar Lane Ecosystems Study Group
Cedar Lane Unitarian Universalist Church Environmental Justice Ministry
Give a Shift
Glen Echo Heights Mobilization
Montgomery Countryside Alliance
One Montgomery Green
Takoma Park Mobilization Environment Committee (TPMEC)
TAME Coalition (Transit Alternatives to Mid-County Highway Extended)
The Climate Mobilization, Montgomery County Chapter

Environmental Health in Nursing

2nd Edition



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A NEW FORM OF ENVIRONMENTAL POLLUTION: WIRELESS AND NON-IONIZING ELECTROMAGNETIC FIELDS

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The wireless revolution and the expansion of the internet of things is rapidly increasing our exposure to non-ionizing electromagnetic fields (EMFs) now considered a new form of environmental pollution (Russell, 2018, Bandara & Carpenter, 2018). Health and medical professionals recommend that we reduce these EMF exposures because of a growing body of research that documents adverse biological effects from low level exposures (Miller, 2019).

This chapter will introduce what EMFs are, how people are exposed, science documenting health effects of exposure, U.S. and international policy on protection from EMFs and nursing implications for clinical practice and advocacy in concert with ANA's principles.

WHAT ARE EMFS?

EMFs are invisible energy waves consisting of electric and magnetic fields. For thousands of years, humans have been exposed to natural EMFs - such as the magnetic field of the earth and light from the sun. However, exposure to human-made EMFs are a relatively recent phenomenon and the more complex data carrying signals of cellular networks have been found to have significant biologic effects. (Panagopoulos, 2015).

Humans are electrical beings. Our cells communicate with tiny electrical impulses which affect our heart, our brain, our nervous system, and our endocrine system. In health care, these electrical impulses are recorded as electric waves on electrocardiograms and electroencephalograms.

IONIZING RADIATION VERSUS NON-IONIZING RADIATION

Electromagnetic fields include two types of radiation: ionizing and non-ionizing. Ionizing radiation has intense high energy, high frequency waves which can remove electrons from atoms or "ionize them" causing cellular damage and directly breaking DNA. Ionizing radiation is known to cause cancer.

Ionizing radiation is used in healthcare both diagnostically (e.g. x-rays and CT scans), and therapeutically to reduce tumors (radiation treatment). Protective precautions such as lead shields and minimizing exposure are required. Health care institutions have procedures for nurses and other staff who with patients receiving ionizing radiation therapy to minimize the health care providers' exposures (Kaiser, 2001).

In contrast, non-ionizing radiation (e.g. Wi-Fi, wireless networks, cell tower radiation) has much lower energy and lower frequency waves. Decades ago, cell phones and wireless networks were brought to market without long term safety studies because the frequencies were non-ionizing and assumed to be safe. While non-ionizing radiation is not thought to cause DNA damage in the same way that ionizing radiation does, recent studies indicate that DNA damage and other adverse health effects can result from non-ionizing radiation, via a more complex indirect process (Lai, 2021, Panagopoulos et al., 2021).

The American Nurses Association Principles of Environmental Health for Nursing Practice were based on a Foundation of Principles including (among them): Human health is linked to the quality of the environment.

- A healthy environment is a universal need and fundamental human right.
- Current generations should meet their needs without compromising the ability of future generations to meet their own needs.
- Pollution prevention should occur at its source. The concern of nurses is the promotion, maintenance, and restoration of people's health.
- Nurses have an obligation to address health disparities and environmental injustice. The nurse collaborates with other professionals, policy makers, advocacy groups, and the public in promoting local, state, national, and international efforts to meet health needs.

(ANA's Principles of Environmental Health for Nursing Practice with Implementation Strategies, 2007)

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There are two main categories of non-ionizing EMF's of scientific research conducted to identify possible biological and environmental effects for over four decades.

- Magnetic Field Extremely Low Frequency (ELF-EMFs)- which are generated anywhere electricity flows such as powerlines, electrical wiring and charging cords.
- Radiofrequency (RF- EMFs) - also known as Radiofrequency Radiation (RFR) -which are the data/information carrying waves of cell phones and wireless networks (Moon, 2020).

In this chapter, unless otherwise noted, the acronym “EMF refers to both ELF and RFF.

WHY ARE EMF EXPOSURES IMPORTANT?

A large and increasing body of research in both human and animal studies have found that even legally allowed low level exposures are linked to a myriad of harmful biological effects including cancer, DNA damage and impacts to reproduction, nervous system and brain development (Bandara & Carpenter, 2018). The effects of new technology on human health are challenging to study because there is no unexposed control group in humans (Russell, 2018.)

SOURCES OF EMF EXPOSURES

Home and School Exposures

People are directly and indirectly exposed to EMFs from cell phones, computers, smart electronics and the myriad of Wi-Fi networks in their homes, workplaces and schools (see table 1). The use of wireless electronics by every age group continues to increase each year (Common Sense Media, 2019). Many school districts have robust Wi-Fi networks and students now use computers in school and at home for hours a day.

The use of electronics close to the body -e.g. laptops on laps, cell phones carried in a pocket or bra- create two kinds of intense EMF exposures to the body part closest to the device- RF from the wireless and ELF from the electricity. In addition, ELF exposures are elevated near charging cell phones, appliances, and electronics (Behrens et al., 2004).

Occupational Exposures

Cell phones, and wireless networks are common in today's workplace -e.g. in hospitals, schools, retail, transportation and numerous industries. There is a critical need to gather health data on these exposures (Stam, 2021). For example, many delivery drivers use cell phones and tablets to track packages and hospital workers often have a cell phone in their pocket, a walkie talkie clipped to their chest, and they use numerous wireless devices over the course of one day.

Cell tower/antenna maintenance workers, physical therapists using diathermy, and operators of dielectric welders have elevated EMF exposures. The latter two directly use high frequency EMFs to generate heat produced by EMFs (Aniołczyk et al., 2015). Overexposure has been documented to induced central nervous system demyelinating disease mimicking Multiple Sclerosis (Raefsky et al., 2020). Although U.S. National Institute for Occupational Safety and Health (NIOSH) scientists developed recommendations to reduce EMF, they were never implemented (Bowman, 2016).

Environmental Exposures

Environmental exposures to non-ionizing EMFs have dramatically increased over the last few decades (Bandara& Carpenter, 2018). People who live near high voltage powerlines and substations may have elevated ELF-

Figure 1



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Table I: Types and sources of EMF exposures

First-Hand Exposure (Devices Used Close to the Body)	Second-Hand Exposure (Devices and Networks Inside Homes, Schools and Buildings)	Environmental Exposure
ELF- EMF and Magnetic fields (*Also emit RF if wireless)		
<ul style="list-style-type: none"> • Cell phones, tablets and laptops * • Electric blankets • Charging phones and electronics * • Alarm clocks and radios plugged in directly near the body such as near beds 	<ul style="list-style-type: none"> • Wiring errors in electrical systems • Electric cars <p>Occupational sources</p> <ul style="list-style-type: none"> • Microwave ovens • Welding equipment • Appliances • Electrical equipment • Motors 	<ul style="list-style-type: none"> • High-voltage power lines • Power cables • Electrical transformers • Substations • Railways and electric trains
RF-EMF		
<ul style="list-style-type: none"> • Cell phones • Cordless phones • Wi-Fi tablets, laptops & computers • Walkie talkies • Wearable technology • Smart watches • Wireless keyboard and mouse • Bluetooth • Wireless Toys 	<ul style="list-style-type: none"> • Wi-Fi networks • Wi-Fi routers • Cordless phone base station • Wireless devices such as: • Baby monitors • Gaming consoles • Speakers • Security systems/hubs- doorbells with cameras • Virtual Assistants • Wireless printers 	<ul style="list-style-type: none"> • Cell towers • Small cell towers aka: Personal Wireless Facilities • Antennas mounted on buildings • Smart Meter networks

EMF throughout their home (Gagsek et al., 2013, Amoon et al., 2020).

Cell tower networks are a significant source of a person's daily RF-EMF exposure, especially in urban areas (Sagar et al., 2018). Cell tower RF-EMF penetrates into homes, especially through windows facing the beam of a nearby wireless antenna (Hardell et al., 2018). The newest generations of wireless - 4G and 5G- will increase RF-EMF as these networks consist of thousands of new "small" cell towers built closer to homes (El Hajj and Naous, 2020, Mzloum et al., 2019). It is estimated that 800,000 new cell towers will be needed in the U.S. (Shepardson, 2018). Researchers caution that increasing cell antennas closer to the ground, close to homes and schools will increase ambient RF exposures to people (Frank 2021, Koppel et al 2022, Pearce 2020).

WHO ARE MOST VULNERABLE TO HEALTH EFFECTS OF EMFS?

Children

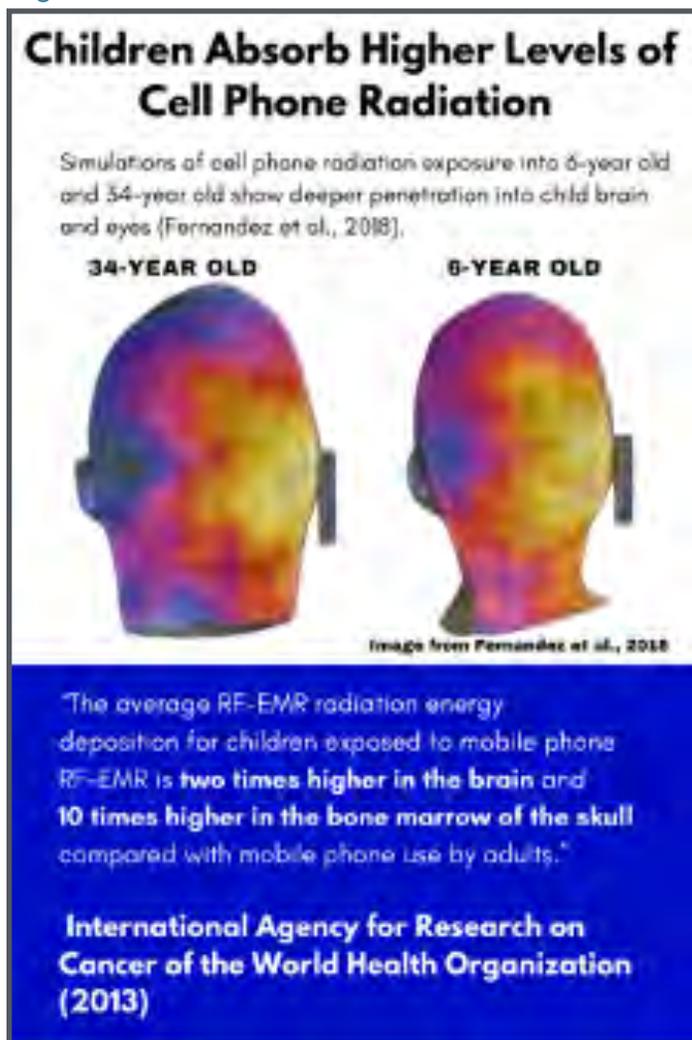
When cell phones first came on the market, no one could imagine the need for a child to use one. Now they are a favorite toy and used as babysitters. Children are uniquely vulnerable to EMFs just as they are to other environmental toxins. As wireless technology is now ubiquitous, children will receive a greater cumulative exposure than today's adults, with exposure starting before they are born (Miller et al., 2019). Both their ongoing physical development and physiology put them at greater risk.

- Children absorb proportionally higher doses of cell phone RF-EMF in the eyes and critical brain regions than adults due to their smaller heads, thinner undeveloped skulls and the higher water content in both their bodies and brain (Fernandez et al., 2018).

- Children’s developing brains are more susceptible to neurotoxic exposures (Redmayne and Johansson, 2014 and 2015).
- Children have more active stem cells and stem cells have been found to be more sensitive to RF-EMF exposure (Markova et al., 2010).
- Safety limits for RF-EMF from cell phones and cell towers are outdated as they were set over two decades ago in 1996 and are based on the body of a large adult, not a child (Gandhi et al., 2012).

Researchers at Penn State Medical Center found reducing EMFs improved health outcomes in preterm infants (Passi et al., 2017). NICU equipment is linked to various impacts to the autonomic nervous system including melatonin production and heart rate and a 2017 review concluded that incubators should be redesigned to reduce exposure to the babies and caregivers (Bellieni et al., 2017).

Figure 2



Used with permission from Environmental Health Trust and Professor Claudio Fernandez.

Pregnancy

As with other environmental toxins, the developing fetus is particularly sensitive to exposure during critical developmental windows. Although more research needs to be done to fully understand the risk during windows of vulnerability, research on pregnant women has linked prenatal cell phone radiation exposure to oxidative stress and DNA damage in cord blood (Bektas et al., 2021); increased risk for miscarriage (Mahmoudabadi et al., 2015), lower birth weight (Lu et al., 2017), fetal growth impacts (Boileau et al., 2020), and preterm birth (Tsarna et al., 2019); as well as emotional/behavioral problems (Divan et al., 2012, Sudan et al., 2016) and hyperactivity (Birks et al., 2017) in their children. Animal studies have linked prenatal wireless exposure to DNA damage (Smith-Roe et al., 2020), brain damage (Tan et al., 2017), memory problems (Shahin et al., 2018) and hyperactivity (Aldad et al., 2012).

A Kaiser Foundation Research Institute team took measurements of the magnetic field ELF-EMF exposure of pregnant women and followed their pregnancies and subsequent birth and health of their children over time. They published a series of studies documenting links between higher prenatal magnetic field exposure (ELF-EMF) and miscarriage (Li et al., 2017) as well as ADHD (Li et al., 2020), obesity (Li et al., 2012), and asthma (Li et al., 2011) in children exposed prenatally.

Watch [BabySafe Project press conference](#) where Hugh Taylor MD, Chief of OBGYN at Yale Medicine and Devra Davis PhD, MPH presented on the scientific basis for the recommendations to reduce exposure.

PHYSIOLOGICAL IMPACTS OF ELECTROMAGNETIC FIELDS

Oxidative Stress and Preexisting Conditions

Reviews of animal and cell studies consistently find even very low EMF exposure associated with increased oxidative stress. Oxidative stress plays a role in the development of many diseases, such as cancer, diabetes, immune and neurodegenerative syndromes. The young, old and/or medically compromised individuals, whose immune system and defense mechanisms are already compromised, are more likely to experience health effects from the increased oxidative stress (Yakymenko et al., 2015, Schuermann & Mevissen, 2021).

Cancer

Researchers have long studied EMFs for their relationship to causation. In 2002, magnetic field ELF-EMF was classified by the World Health Organization International Agency for Research on Cancer (WHO/IARC) as a Group

2B possible carcinogen due to research findings that showed a relationship between residential exposure and increased childhood leukemia risk (WHO/IARC 2002). This association continues to be reported in more recent studies (Carpenter 2019, Seomun et al., 2021).

In 2011, the WHO/IARC concluded that wireless radiofrequency radiation (RF-EMF) was a Group 2B possible carcinogen largely based on studies of long term cell phone users with increased tumors-glioblastomas and acoustic neuromas (WHO/ IARC 2011). Several international experts conclude RF-EMF is a proven Group I human carcinogen (Miller et al., 2018, Peleg et al., 2018 Carlberg and Hardell 2017, Belpomme et al., 2018).

Examples of new scientific research that finds a carcinogenic effect for RF-EMF include:

- Two major animal studies investigating long-term exposure found the same tumors as found in human studies (U.S. National Toxicology Program, 2018, Falcioni et al., 2018).
- A 2020 meta-analysis linked cumulative cell phone use over 1000 hours increased tumor risk (Choi et al., 2020).
- Studies have found women who carry cellphones in the bra have elevated breast cancer risk (West et al., 2013, Shih et al., 2020).
- A Yale study funded by the American Cancer Society found elevated thyroid cancer risk in heavy cell phone users with specific genetic susceptibilities (Luo et al., 2020).

Reproduction

Systematic reviews associate RF-EMF with impacts to sperm (Kim et al., 2021, Yu et al., 2021) and decreased testosterone (Maluin et al., 2021) leading many researchers to conclude “it is recommended to keep the cell phone away from the pelvis as much as possible” (Hassanzadeh-Taheri et al., 2021).

Nervous System Impacts

The nervous system is sensitive to EMFs (Bertagna et al., 2021). Cell phone radiation has been found to alter brain activity (Volkow et al., 2011, Bin et al., 2014), impact neurotransmitters and alter neuron development (Kaplan et al., 2015, Li et al., 2021, Chen et al., 2021). Teenagers were found to experience memory damage to the area of the brain most exposed to cell phone radiation after just one year (Foerster et al., 2018).

Experimental animal research has found a variety of RF-EMF impacts especially in the brain regions critical to memory and learning (Sonmez, et al., 2010, Dasdag et al., 2015, Shahin et al., 2018, Obajuluwa et al., 2017, Tan et al., 2021, Hasan et al., 2021).

Electromagnetic Hypersensitivity

In 2021, scientists published a consensus statement calling for the acknowledgement of electrohypersensitivity as a distinct neuropathological disorder (Belpomme et al., 2021) and exposure to non-ionizing radiation has a series of ICD 10 codes.

Electromagnetic hypersensitivity (EHS) is characterized by the development of numerous symptoms linked to EMF exposure including: headaches, sleeping problems, concentration problems, nosebleeds, unexplained skin rashes, digestive problems, neurological problems, heart palpitations and disabling fatigue (Belyaev et al., 2016).

Synergistic Effects

EMFs can add to our total body burden of carcinogens. Research has found that EMF exposure can act synergistically with other environmental pollutants potentiating harmful effects (Kostoff and Lau, 2017). For example, prenatal and postnatal mobile phone exposure has been linked to greater neurobehavioral effects in children with elevated lead levels (Choi et al., 2017, Byun et al., 2017).

It is challenging to isolate an association epidemiologically because there is no unexposed control group (Russell, 2018.) Scientists must therefore rely on animal experiments which are carefully controlled to understand if the effects are caused by the exposure.

Animal studies have found combining ELF-EMF exposure with known carcinogens can increase tumors (Soffritti et al., 2016, Soffritti et al., 2016). EMFs can increase permeability of the blood brain barrier, thus, allowing more toxic agents to reach the brain (Sirav and Seyhan, 2016, Tang et al., 2015).

EMFs and the Environment

There are reports that the proliferation of cell antennas will have numerous environmental effects. Analysis are accumulating that electricity and energy consumption of 5G and new wireless networks will contribute to greenhouse gasses and exacerbate climate change (The Shift Project, 2019, Williams et al, 2022).

Further, trees are critical to a healthy environment. They filter toxic chemicals from the air, reduce ground-level ozone and absorb carbon dioxide emissions that are driving climate change (Terzaghi et al., 2020, Bastin et al., 2019). There are studies finding that cell antenna RF-EMF can injure trees (Waldmann-Selsam, C., et al., 2016, Breunig, 2017, Haggerty, 2010) and impact plant growth (Halgamuge, 2017, Pall, 2016).

A 2021 research review on effects to wildlife published in *Reviews on Environmental Health* references more than 1,200 scientific references which found impacts to wildlife, including pollinators, from even very low intensities of non-ionizing EMFs including impacts to orientation and migration, reproduction, mating, nest, den building and survivorship (Levitt et al., 2021a, b, c). The authors assert that the current body of science should trigger urgent protective regulatory action to protect wildlife.

A COMPLEX SCIENCE WITH LIMITED PROTECTIVE FEDERAL REGULATION AND HEAVY INDUSTRY INFLUENCE

U.S. and international scientists are calling for an update to the 1996 federal regulations and the need for independent research reviews in order to ensure the public is protected (Hardell & Carlberg, 2020). Similar to other environmental pollutants, literature reviews show conflicting results and industry funding has long been found to influence the results both in ELF and RF research (Hardell et al., 2006, Carpenter 2019, Huss et al., 2017). The official reports of many authorities have been criticized as having major conflicts of interest (Hardell 2017, Buchner & Rivasi, 2020).

The book, “Captured Agency” (Alster, 2015) identified a “revolving door” between industry, Congress and the Federal Communications Commission. The investigation compared the tactics of the wireless industry to Big Tobacco citing the heavy industry lobbying, the funding of science that shows no effect and the massive public relations campaigns designed to attack the credibility of the science and of scientists who do find harmful effects.

U.S. Policy

The Federal Communications Commission (FCC) established human exposure limits for cell phones and cellular network RF-EMF in 1996 and they have not been updated despite the dramatic changes in wireless communications in the last 25 years. The FCC is not a health agency and does not have medical or public health experts on staff. In 2021, a federal court ruled that the FCC needed to reexamine their decision to retain the 1996 limits (No. 20-1025, 2021). To date, governmental

health and environmental agencies such as the Environmental Protection Agency (EPA), the Food and Drug Administration (FDA), the Department of Health and Human Services and National Cancer Institutes have not reviewed the totality of the latest science on health effects of EMFs.

In 2018, the U.S. National Toxicology Program (NTP) found “clear evidence of cancer” and DNA damage in a large-scale animal study designed to evaluate the effects of long term exposure to radio frequency radiation from cell phones (U.S. National Toxicology Program, 2018). Although the FDA requested the studies, they rejected the study conclusions. Research analyzing the NTP findings conclude U.S safety limits need to be strengthened by 200 to 400 times to protect children according to current risk assessment guidelines (Uche & Naidenko, 2021).

The American Academy of Pediatrics has long recommended that FCC limits be updated to protect children and pregnant women (AAP, 2012 & 2013). In addition, cell phones and electronics are not tested the way people use devices today- in body contact positions. Although it is now commonplace to see children watching videos with a cell phones pressed against their chest, research has found that when phones are tested for exposure levels in body contact positions, they can exceed government limits up to 11 times the FCC limit (Gandhi, 2019). Pregnant women rest cell phones laptops on their abdomens, and research finds these positions create RF-EMF exposures into the fetal brain (Cabot et al., 2014) and can induce ELF-EMF in the fetus Bellieni et al., 2012).

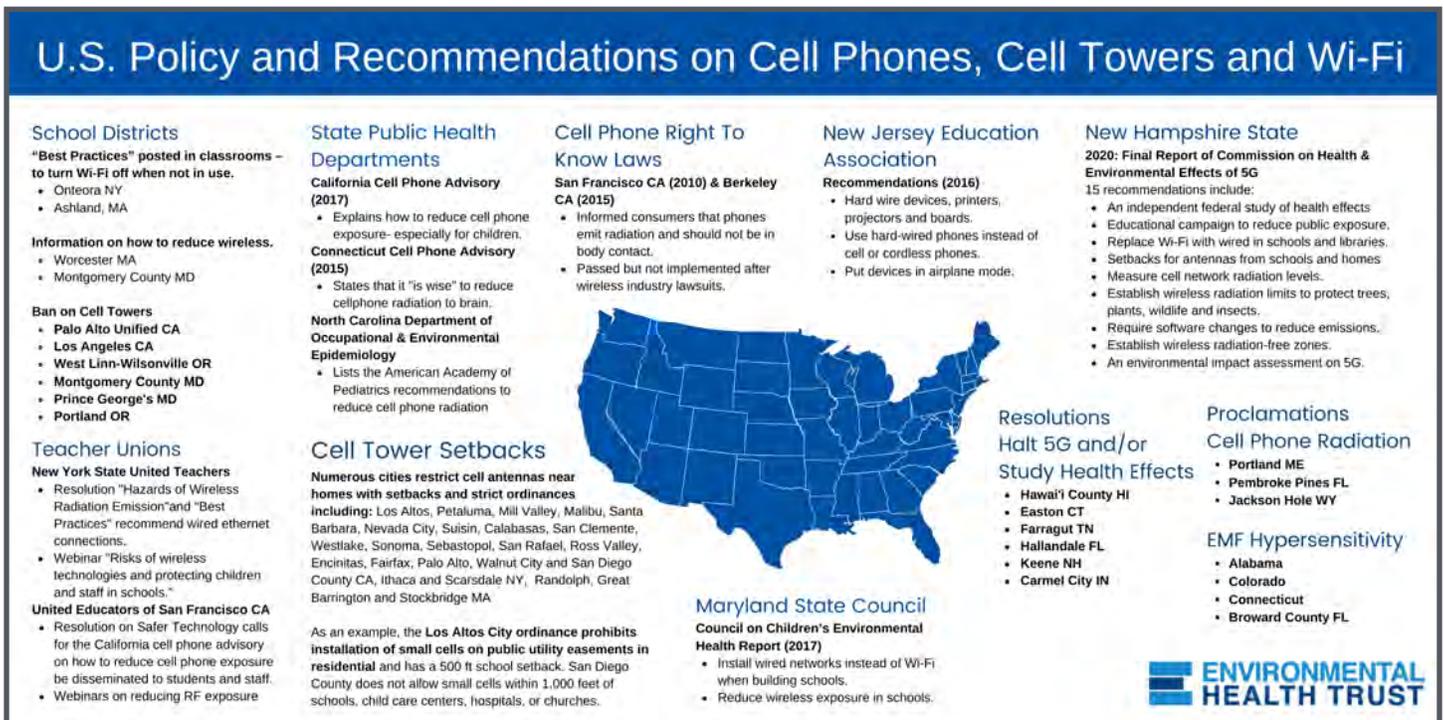
Magnetic and ELF Safety Limits

The United States has no federal safety limit for magnetic fields or ELF-EMF. In contrast, over a dozen countries have some level of protective policy in place and they limit building homes in areas with magnetic field levels higher than the levels associated with childhood leukemia (Stam, 2018).

State and Local Policies

In the US, many states and localities have enacted laws related to Cell/Tower/Antenna placement. Physicians for Safe Technology and the Environmental Health Trust track state legislation and local ordinances. In 2020, the New Hampshire State Commission on 5G issued 15 recommendations which included several recommendations including large setbacks to distance cell antennas from homes and schools, replacing Wi-Fi with wired in schools and a public health campaign to educate families.

Figure 3



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International Policies and Actions

Internationally governments have policies and regulations in place to inform the public and reduce exposures. Numerous scientists, medical and public health professionals have issued appeals and recommendations on the need to reduce exposure to electromagnetic radiation and pause the proliferation of new untested networks (EMF Scientists Appeal, 2015, Di Ciaula, 2018, Mallery-Blythe, 2020, Nyberg & Hardell, 2017)

- Switzerland, Italy, China, Russia, India, Israel and several European countries have far more stringent cell tower radiation emission limits compared to the US FCC and many define homes, schools and kindergartens as "sensitive areas" (Stam, 2017).
- Over a dozen countries have clear recommendations that people reduce exposure to cell phone radiation, especially for children (Redmayne, 2016, EHT, 2021).
- France has several policies including: limiting Wi-Fi in classrooms, banning the sale of cell phones designed for young children, banning advertisements aimed at children under 14 years old. Consumers are informed with instructions to use speakerphone, limit children's use and "keep away from the belly of pregnant women and lower abdomen of adolescents."
- Cyprus and French Polynesia have multimedia public education campaigns (EHT, 2021).

- A major hospital in Cyprus removed Wi-Fi from the pediatric Intensive Care Unit and Neonatal units (Cyprus Committee on Environment and Children's Health, 2019).

IMPLICATIONS FOR NURSING PRACTICE

In 1992, the International Council of Nurses made environmental health, preventing illness by eliminating environmental toxins a priority (as cited in ANA's Principles of Environmental Health for Nursing Practice with Implementation Strategies 2007). Nurses can protect human health and the environment through prevention, clinical practice, and advocacy.

Prevention

Nurses are trusted advisors. Nurses must first protect themselves and their families, their patients, and their communities by learning how to decrease exposures to EMFs. Small lifestyle changes can significantly reduce cellular damage of our total lifetime exposure. We can then educate our patients- especially parents and vulnerable populations. Nurses can work in coalition with other groups to educate why and how to reduce EMF exposures in the workplace, schools, and communities. People need to know how to eliminate unnecessary sources of EMFs and choose safe alternatives. Tips and checklists follow.

Table 2: Ways to reduce exposure to cell phone radiation

American Academy of Pediatrics Reducing Cell Phone Radiation Recommendations

- Prefer texting to voice calls
- Use cell phones in speaker mode or hands-free.
- Hold cell phone at a distance from head.
- Make only short or essential calls on cell phones.
- Avoid carrying your phone against the body like in a pocket, sock, or bra.
- Do not talk on the phone or text while driving.
- If you plan to watch a movie on your device, download it first, then switch to airplane mode while you watch in order to avoid unnecessary radiation exposure.
- Minimize use in areas of low signal (i.e. how many bars you have). The weaker your cell signal, the harder your phone has to work and the more radiation it gives off.
- Avoid making calls in cars, elevators, trains, and buses. The cell phone works harder to get a signal through metal, so the power level increases.
- Remember that cell phones are not toys or teething items.

(American Academy of Pediatrics, 2016)

Resources on How To Reduce Cell Phone Radiation

- [EHT Steps to Reduce Cell Phone Radiation](#)
- [Cell Phone Tip Card from Grassroots Environmental Education](#)
- [Downloadable Posters on Reducing Cell Phone Radiation](#)

Reducing EMFs During Pregnancy

During pregnancy, new parents are highly motivated to learn everything they can to have a healthy baby. This is a great opportunity for nurses to give parents information.

The [Baby Safe Project](#) website includes [five simple ways to reduce exposure](#), downloadable brochures in French and Spanish.

Reducing EMFs at Home

- Replace cordless phones with corded telephones
- Minimize wireless use. Start by turning Wi-Fi off at night. Then install wired ethernet connections instead of Wi-Fi.

Reducing EMFs at Home (Cont.)

- Use wired mouse, keyboard, speaker, and printer.
- Use wired alarm systems and doorbells not wireless
- Keep devices on a table off the lap/body.
- Do not use wireless speakers or virtual assistants.
- Keep mobile devices and chargers out of bedrooms.
- Eliminate baby monitors and wireless cameras.
- Refuse Smart meters and request analog, non-wireless utility (water, electricity, gas) meter options.
- [Safe Technology at Home](#)
- [Checklist for Reducing EMF at Home](#)
- [How to Connect Your Laptop with Ethernet Instead of Wi-Fi](#)

Tips for Reducing Magnetic Field EMF

- Use tablets, laptops and electronics on a table, not the lap.
- Do not use a cell phone or device while it is charging.
- Charge phones and devices away from beds and away from your body.
- Remove screens and electronics from the bedroom - especially around your bed and the crib.
- Avoid sleeping with electric blankets and heating pads.
- Ensure you are not sleeping against a wall with the utility meter on the other side.
- Get magnetic field measurements, especially if you live close to high voltage power lines.
- [Building science and radiofrequency radiation: What makes smart and healthy buildings: Reduce EMF](#)
- [Collaborative for High Performance Schools Reduce RF and Low EMF Criteria](#)
- [How to Reduce EMF in Schools](#)
- [Safe Tech for Kids: What to do about children's increased use of technology during Covid-19](#)

Clinical Practice

Nurses can integrate their understanding of EMFs into their clinical practice and include interview questions about technology use and EMF exposure in their assessments. When patients present with EHS symptoms, such as headache, insomnia, irritability, they should be further assessed for EMF sensitivity.

Helpful Resources include:

- [Physicians for Safe Technology](#) EHS information includes Clinical Interview Questions

- [Austrian Medical Association EMF Guidelines](#) Has algorithms and a sample patient questionnaire.
- [The Environmental Health Clinic, Women's College Hospital at the University of Toronto Practice Guidelines for Diagnosis and Treatment](#) (Bray, 2020)
- [EMF Medical Conference 2021 offers CME Online](#)
- [Electrosensitivity Society](#) Providers in US and Canada

ADVOCACY

Protecting Health Requires Nurses To Be Advocates for Systematic Policy Change

Just as with other environmental issues, nurses have a responsibility to act to protect individuals and communities by supporting meaningful policy change.

Nurses bring credibility on health issues to advocacy and our voices are important in developing protective policy. Working in coalition with other organizations always strengthens the message (e.g parent groups, environmental organizations, faith-based organizations, etc.).

- Nursing organizations can adopt resolutions or policy positions on wireless and EMF exposures. See the resolution of the California Medical Association.
- Nurses can join “safe tech” organizations and coalitions to support policies that reduce EMF exposures in our workplaces, schools, and communities. These include the citing of small cell antennas in neighborhood and sensitive areas and advocate for wired internet connection to and into the building: FASTER, SAFER, RELIABLE, and if it is a municipal/community partnership, it will eliminate the digital divide. Learn more at: [SafeG.net](#)
- Nurses and nursing organizations fighting climate change can lobby elected officials to take into account the carbon footprint of wireless technology. Download Environmental Health Trust's Fact sheet on 5G and Climate Change which describes research showing escalating energy consumption from 5G networks.
- As environmental health advocates, nurses can educate and work with schools, parents, teachers, and unions to reduce EMF exposures in schools, replace Wi-Fi with wired internet connections and ensure cell towers are not built near schools or daycare centers.

RESOURCES

Resources for Safe Schools

[Environmental Health Trust](#)

[Physicians for Safe Technology](#)

[Santa Clara Medical Association](#)

[Wi-fi In Schools: Are We playing It Safe With Our Kids?](#)

[Shallow Minds: How the Internet and Wi Fi in Schools Can Affect Learning](#)

[How To Reduce EMFs in Schools](#)

[New Jersey Education Association Article, PDF of Recommendations](#)

[Maryland State Children's Environmental Health and Protection Advisory Council](#)

[Collaborative for High Performance Schools Low EMF Criteria](#)

[Grassroots Environmental Education](#)

[Environmental Health Trust Checklist for Schools](#)

Websites

[Environmental Health Trust](#)

[Environmental Working Group](#)

[Physicians for Safe Technology](#)

[Americans for Responsible Technology](#)

[Dr. Joel Moskowitz](#), UC Berkeley School of Public Health, Director, Center for Family and Community Health

Educational Webinars

[Dr. Joel Moskowitz “Health Effects of Cell Phones and Wireless: Implications for 5G” Center for Occupational and Environmental Health Webinar](#)

[Dr. Devra Davis “Children, Wireless Radiation and Health” Cyprus Pediatric Symposium](#)

[Expert Webinar “What Environmental Health Leaders Need to Know”](#)

Downloads/Printables

[EHT Posters and Factsheets](#)

[American Academy of Pediatrics Letters](#)

[Santa Clara Medical Organization](#)

Books

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Radiation from smartphones may up miscarriage risk: study

Press Trust of India | Washington December 14, 2017 Last Updated at 18:15 IST

Exposure to non-ionising radiation from smartphones, wi-fi routers and microwaves during pregnancy may significantly increase the risk of miscarriage, a study warns.

Non-ionising radiation from magnetic fields is produced when electric devices are in use and electricity is flowing.

It can be generated by a number of environmental sources, including electric appliances, power lines and transformers, wireless devices and wireless networks.

Humans are exposed to magnetic fields via close proximity to these sources while they are in use.

While the health hazards from ionising radiation are well-established and include radiation sickness, cancer and genetic damage, the evidence of health risks to humans from non-ionising radiation remains limited.

"Few studies have been able to accurately measure exposure to magnetic field non-ionising radiation," said De-Kun Li from Kaiser Permanente Division of Research in the US.

Researchers asked women over age 18 with confirmed pregnancies to wear a small (a bit larger than a deck of cards) magnetic-field monitoring device for 24 hours.

Participants also kept a diary of their activities on that day, and were interviewed in person to better control for possible confounding factors, as well as how typical their activities were on the monitoring day.

Objective magnetic field measurements and pregnancy outcomes were obtained for 913 pregnant women, said Li, principal investigator of the study.

Miscarriage occurred in 10.4 per cent of the women with the lowest measured exposure level of magnetic field non- ionising radiation on a typical day, and in 24.2 per cent of the women with the higher measured exposure level, a nearly three times higher relative risk.

The rate of miscarriage reported in the general population is between 10 and 15 per cent, Li said.

"This study provides evidence from a human population that magnetic field non-ionising radiation could have adverse biological impacts on human health," said Li.

Full Name (First and Last): Gladys Moreno Fuentes

Name of Organization or Community: The Hartford Coalition for Safe Technology

City and State: Hartford, CT

Brief description about the concern: Dear Members of the White House Environmental Justice Advisory Council, Hartford, CT is an Environmental Justice community that is home to a number of regional waste facilities, including a medical waste plant, a sewage treatment facility and a recycling facility . We have been impacted for years by a landfill and trash incinerator. We breathe in smog created by highway and city traffic. Thus, the residents of Hartford already carry an undue environmental burden for the region. The 5G antennas so near our homes add to this burden. Yet, hundreds of 5G antennas have been placed in Hartford neighborhoods, exposing our families and children to radio frequency radiation that can very well impact our health. These antennas have been placed in our neighborhoods without input from the residents. Objections to their placement have been made to the state Public Utilities Regulatory Authority (PURA) without success. The telecommunications companies must notify property owners before installing a small cell antenna, but the tenants who are the actual residents are not required to be notified. It appears that neither the telecoms, nor the state, nor the city has taken responsibility to monitor the antennas to ensure that they are working properly and that emissions are within allowable limits. We ask that you advocate for this and the updating of FCC safety standards for radio frequency emissions. They have not been updated since the 1990s and need to reflect more recent scientific findings on the health and environmental impacts of these emissions. We believe the focus should be to invest in fiber optic infrastructure and utilize existing fiber optic infrastructure and put a halt to 5G antennas until we know more about the health and environmental impacts.

What do you want the WHEJAC to advise the White House Council on Environmental Quality to do?:

Please consider the following:

1. Dr. Joel M. Moskowitz, in a Scientific American article entitled “We Have No Reason to Believe 5G Is Safe” states that there are hundreds of studies linking electromagnetic wave exposure to health issues such as cancer, neurological disorders, and reproductive harm.
2. Over four hundred scientists and medical doctors have signed an international appeal calling for a delay in implementing 5G technology until we know more about the health impacts.
3. Senator Blumenthal has called for a delay in implementing 5G technology until more about the health impacts can be understood.
4. Theodora Scarato, Executive Director of Environmental Health Trust, has stated: “Insects, birds and airborne species are unprotected as regulations do not apply to wildlife. Trees, plants and bacteria are also impacted by RF, yet are ignored by human centric regulations.” And, with respect to EHT et al. v FCC, she added that “the FCC had ignored scientific evidence on environmental effects.”
5. There needs to be ongoing monitoring of the 5G antennas radiation, especially in Environmental Justice communities that are impacted with so many other environmental hazards.
6. EJ advisory committee to advocate for an updating of FCC safety standards for radio frequency emissions. They have not been updated since the 1990s and the standards need

to take into more recent scientific findings of health and environmental impacts of these emissions.

7. To put a halt to 5G antennas until we know more about the health and environmental impacts and to invest in fiber optic infrastructure and utilize existing fiber optic infrastructure in the communities that already have it.

We ask that this be considered an environmental justice issue.

Sincerely,

Gladys Moreno Fuentes

Hartford Coalition for Safe Technology

Full Name (First and Last): Jennifer Hamad

Name of Organization or Community: Stanford University

City and State: Houston, Texas

Brief description about the concern: Good afternoon White House Environmental Justice Advisory Council, My name is Jennifer Hamad, and I am a current undergrad at Stanford University and an avid environmental justice and climate activist and researcher. For the past two years, I have done extensive research into the harrowing water lead crisis in the U.S. that continues to place the health of approximately 36.5 million or 50% of all American children at risk, according to Vice President Harris who has declared water lead contamination a national emergency. Research, including my own, have elucidated the extensiveness and severity of the current water lead crisis and the disproportionate effect it has on low-income communities of color. Thus, not only is lead water contamination a public health crisis but an issue of classism and racism as well.

Although no amount of lead exposure is deemed safe and even small amounts of lead exposure have been attributed to brain damage, gastrointestinal, reproductive, and renal problems, behavioral issues, hearing impairment, and anemia, according to the American Academy of Pediatrics, water lead contamination remains unregulated in 88% of American public schools under the current Lead and Copper Rule. According to a study put out by the U.S. Government Accountability Office in 2018, of the 43% of school districts that tested their water, already 37% found water lead levels above the 15ppb actionable limit. Thus, water lead contamination in American public schools is widespread and severe.

Despite the 2021 revisions to the Lead and Copper Rule, it remains anemic and lacks the ambition needed to eliminate this environmental justice and public health issue. The revised Lead and Copper Rule will only require testing of approximately 20% of public schools and childcare facilities served by water systems and will maintain 15ppb as the actionable water lead level, triggering lead service line replacement. Thus, so long as children are ingesting below 15ppb of lead, their water is treated as safe; in this way, current legislation fundamentally fails to protect children across the nation from toxic lead exposure.

What do you want the WHEJAC to advise the White House Council on Environmental Quality to do?:

Until the water lead crisis in the U.S. is ameliorated, our agencies will not successfully achieve the environmental justice goal of providing safe drinking water to the American people; this is why it is imperative that the issue be of priority to the White House Environmental Justice Advisory Council and be of focus in the Environmental Justice Scorecard. In order to measure the progress of our nation in addressing the water lead crisis, we must monitor water lead contamination and blood lead level data across the nation in correlation with socioeconomic and racial data in the Environmental Justice Scorecard. Monitoring blood lead level data in this way will allow our agencies to determine the effectiveness of future investments made into not only eliminating water lead contamination but achieving environmental justice and equity in health and safety. I also call upon our agencies to consider investing in the expansion of lead surveillance in public schools and the development of a robust and expeditious remediation plan to eliminate lead exposure when any amount of water lead contamination is detected in our communities.

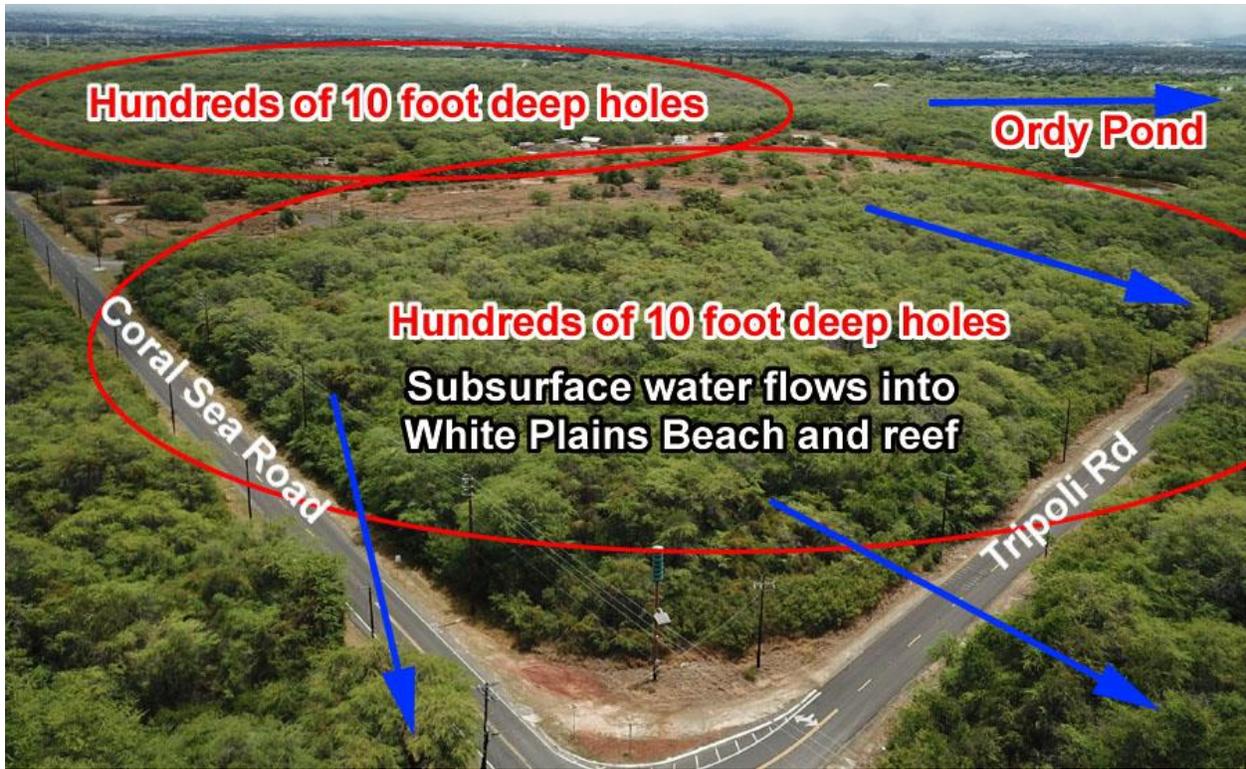
Happy 60th Anniversary of Pacific A Bomb Tests When Hawaii Bathed in A Bomb Blasts, freaking some people out, others lined beaches to watch, KPOI did countdown and then knocked off the air. Lights went out in Manoa Valley. Fun Atomic Bomb times in Honolulu. Innergex Barbers Point Solar PV project will spread massive amounts of toxic chemicals into the Ewa Beach shore and reefs, ecosystem, resulting in massive community lawsuits.

Attached HCDA Comments: The largely unknown but very well documented massive PCB, PFAS Forever Chemicals, Cold War A Bomb residue all over former NAS Barbers Point. Hunt Corp of Texas moving massive amounts of contaminated soil for west side development. Beaches, reef and ocean ecosystem, Haseko Lagoon will be massively further contaminated with Forever Chemicals as highly industrialized DHHL Barbers Point Solar PV project drills hundreds of 10 foot deep holes into highly transmissive Karst waterways, caves connected with tide up to two miles inland.

The large canal next to the secret Navy Toxic waste PCB facility already has very high level PFAS Forever Chemicals documented. The Toxic waste facility is right next to the Manhattan Project Atomic Energy Commission A Bomb facilities where A Bombs were dropped by B-52's in the 1960's. The area was later used by US Navy for 70's-80's A4 SkyHawk and P3 Orion nuke weapons operations. Nukes stored at today's Kalaleoa Heritage Park and on DHHL parcels planned for Solar PV with hundreds of 10 foot deep holes to spread toxic chemicals all over Ewa Beach and Leeward coast.

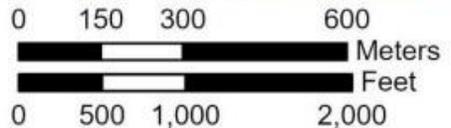
City Parks will not take Navy BRAC 500 acres because of Forever Chemical contamination. Navy NavFac has all of the documents however they are classified as "sensitive" and require FOIA. At least one death and other illnesses covered up at Barbers Point Riding Club where materials from Navy A Bomb ship hulls were sand-blasted and dumped there and around NASBP for land fill. See reports on the massive problems at Treasure Island Navy Base which was directly part of the NASBP "Area 95" A Bomb tests.

John Bond
Ewa Historian





 Revised Barbers Point Solar Project Area



Navy Toxic Chemical Dump Located Next To Atomic Bomb Facilities in HCDA Kalaleoa- Threatens Ewa Beaches, Reef Eco-system

Many Navy Reports, Documents still classified SENSITIVE and must be FOIA'ed. NAS Barbers Point was part of the MANHATTAN ENGINEER DISTRICT (1945-1946) which grew out of the original Top Secret Manhattan Project that produced two atomic bombs during WW-II. The Barbers Point naval airbase bomb facility was called "Site 95."

John Bond Ewa Historian

6/28/2022

60th Anniversary: JULY 20, 1962, Pacific A Bomb test seen by thousands in Hawaii. Navy washed off planes that flew through Pacific atomic bomb blasts at NASBP and likely on former MCAS Ewa. Hulls of numerous Pearl Harbor ships involved in the A Bomb tests were later sand blasted and that residue was dumped in places around the former Barbers Point NAS base because they thought it was safe for land fill. Some of the sand blast materials were used by the Barbers point Riding Club for horse arenas and general fill. There have been mysterious illnesses and one death reported.

NAS Barbers Point shares a very close historical relationship with early atomic bomb tests and nuclear waste disposal issues such as washing down bomb test aircraft, disposing of ship test materials, radiation dosimeter badges, and artifacts from the many decommissioned ships that were involved in the tests. Many of the test ships and materials were also sunk off shore of Barbers Point. Other materials were reportedly buried in local landfills around the NASBP base. Hunt Corp is removing massive amounts of contaminated soils from the west side of former NASBP.

Ordy Pond where RAD Badges and other materials may have been disposed had three massive cleaning contracts, the last was extremely extensive and damaging. A bomb test monitoring planes that flew through atomic blast clouds were washed off at NASBP and likely at a recently discovered plane washing area at MCAS Ewa that may be the reason why the Navy BRAC transfer of lands to City Parks has been delayed for at least 12 years. "Forever Chemicals" PFAS used in Navy fire fighting foam and aircraft decontamination cleaning may be the reason. Recently very high concentrations of PFAS have been reported in a large canal next to NASBP.

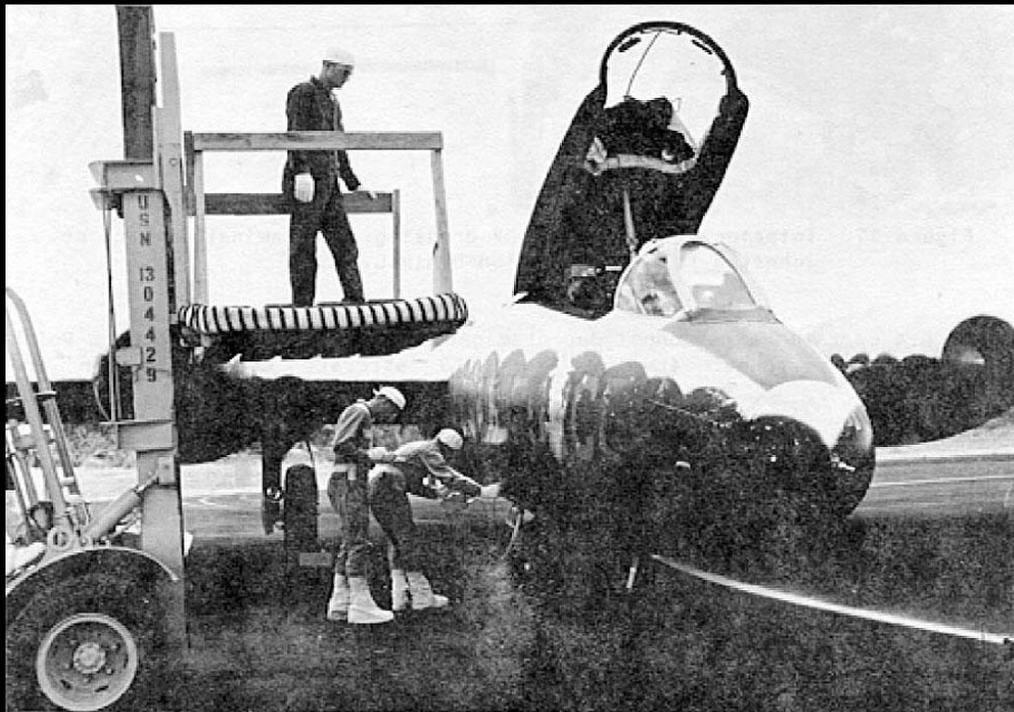


Figure 37. Crews prepare to decontaminate a B-57 sampler after crew and sample removal, Naval Air Station, Barbers Point, Operation DOMINIC.

Atomic bomb clouds were flown through by B-57 and the planes later washed off on Barbers Point taxiways that were part of the weapons testing area.

Also the hulls of numerous Pearl Harbor ships involved in the tests were later sand blasted and that residue was dumped in places around the former Barbers Point NAS base because they thought it was safe for land fill. Some of the sand blast materials were used by the Barbers

point Riding Club for horse arenas and general fill. There were reportedly at least one death that may have been associated with the toxicity of the materials but it was all kept quiet.

Nuclear waste contamination issues have been extensively documented at San Francisco former Treasure Island Navy Base which was directly involved in the 1960's NAS Barbers Point Pacific Island Atomic Bomb tests.



Several years ago Navy NavFac trucks came over to the Barbers Point stables located in the WW-II Ewa aircraft revetments to scoop up the Pearl Harbor Shipyard sand blast material and take it all away, likely to the Navy Barbers Point toxic material and land fill site operated by a private contractor. The same processing land fill processing facility is directly next to the former NASBP nuclear test program and weapons storage facilities. Today there are still reportedly classified environmental base closure issues still pending for NASBP land and the long delayed City Parks land transfer.

Hunt Corp of Texas contractors have been hauling contaminated coral soil in open trucks and dumping on a growing hill 40-50 feet high on Parcel 12 for several months. The contaminated soil (which is what it was called in an HCDA stakeholders meeting) is also being blown all over nearby Kalaeloa DHHL homes, FBI building, superette gas station fast food facility, Kalaeloa businesses, sports facilities and Army clinic. The soil is also being dumped at the Navy contracted toxic soil facility next to a large long canal where high concentrations of PFAS chemicals were recently detected. Kapolei homeowners suffering from respiratory problems and property damage because of heavy dust kicked up from nearby construction project won \$2.1 million in an out of court settlement around 10 years ago.



The scale of the Hunt contaminated soil dumping on Parcel 12 has grown massively over several months



A wide range of contaminated soils have been dumped along Franklin D. Roosevelt Avenue in Kalaeloa.

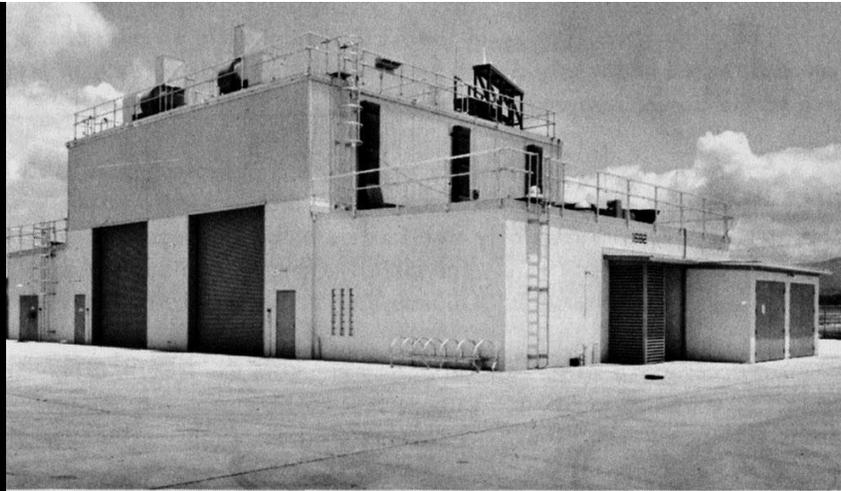




Massive toxic soil stockpile, likely from Hunt Corp NASBP west construction, can be seen across the ramp and runway from former NASBP air museum location. The largely secretive Navy NavFac toxic soil treatment facility takes in contaminated soil from all of the military bases on Oahu. After trying to secretly hide a toxic soil burial plan from the public, it was revealed that they went ahead and dumped soil with plastic covers while not (intentionally) understanding that rain would wash all of the toxic soil into the subsurface karst ancient reef, into the large canal and contaminate all of the fishery ecosystem and swimming beaches along the Ewa and Leeward reefs and beaches.



Just below this toxic waste soil facility is a US Fish and Wildlife preserve where school kids are taken to show them restored karst sinkholes with Opae Ula shrimp. The preserve also has endangered native Hawaiian plants and local residents have seen the endangered Pueo owls hunting along the canal areas. Also just above the soil dumping facility is a proposed DHHL solar project and a large drained sinkhole pond- as a result of the construction of the large Kapolei "Second City" storm drain canal circa 1970's. For years residents have reported seeing human remains (likely iwi kupuna) in the many caves and crevasses along the canal. A couple of years ago the canal was stripped of vegetation and the clearly seen caves and reported iwi burial areas were covered over with concrete.



Barbers Point Assembly Bldg.

The 1969 Barbers Point Assembly Bldg for later bomb tests. Barbers Point was involved in all of the nuclear tests in the Pacific. Numerous declassified DoD documents, some only recently, detail the use of building 278 to assemble the "device" (actually more than one) for the 1962 Dominic tests flown by B-52's from Kirkland AFB. Building 1682 was built a few years later. See the section on films, photos and maps of all of the A bomb and later nuclear weapons facilities at NAS Barbers Point. Today the high security nuclear weapons facilities are used by DHHL parcel tenants.



B-57 recon jets were flown through the blast cloud areas and then back to NAS Barbers Point. They were "decontaminated" by being washed off with foam detergents, possibly containing PFAS, at the base and likely over at a former MCAS Ewa ramp where a coral taxiway had been constructed to the fire fighting foam washing area. The City Parks department for the past 12 years has never taken the Navy BRAC lands because of a "forever chemical" issue- likely PFAS.



Above shown are slightly visible remains of what was the likely aircraft fire fighting foam wash area. A visit to the site reveals an approximate 2 foot high berm in a rectangular shape with remnants of a water supply connection. Bottom left shows the coral taxiway connection to NASBP which allowed aircraft to cross Coral Sea Rd from Barbers Point. The area has a slight slope where water and foam could drain into a large coral excavation pit area used for land fill during WW-II. The Navy BRAC deed states that there is contamination in this area and that the large coral pit should only have restricted public use.

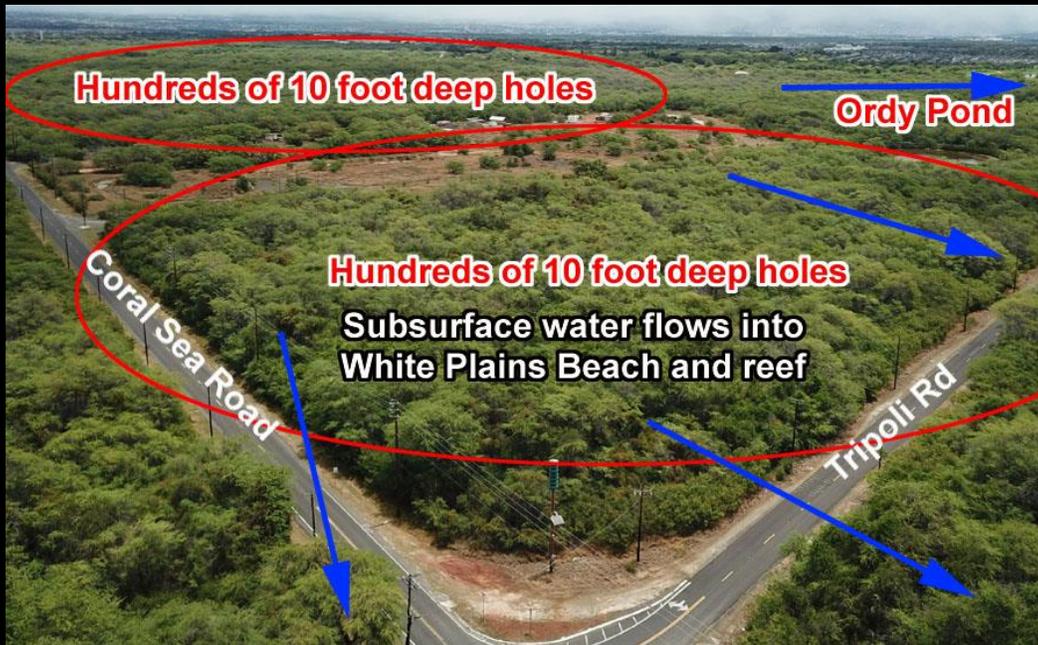
Later nuclear bombs for A4 SkyHawk and P3 Orion were stored at what is today the Kalaeloa Heritage Park where a special "hot pad" allowed loading and unloading of nuclear bombs from a main now State airport sea facing runway. In the 1960's special B-52 bombers loaded then large atomic bombs for dropping in the Pacific test range. See the sections showing film, photos and documentation of this.

Reportedly some atomic bomb project material was thrown into Ordy Pond- such as RAD Badge, dosimeters, etc. Ordy was massively cleaned three times, the last being a 2 mil NavFac contract that destroyed many of the Hawaiian sites around its perimeter using very heavy construction equipment. This was illegally authorized by then Hawaii SHPD administrator Pua Aiu who secretly overrode the directions of Theresa Donham, then SHPD Chief Archeology branch.

High concentrations of PFAS were recently documented in the large NASBP canal next to the atomic weapons testing facility. PFAS are found in many things including fire fighting foams and special detergents used to clean aircraft and mechanical parts. PFAS "Forever Chemicals" have been holding up the transfer of Navy BRAC lands to the Honolulu City Parks department. The Navy deed of transfer warns that before there can be any major development that the soils must be remediated. Hunt Corp is removing massive amounts of contaminated soil from their NASBP west side developments.



Figure 39. Washdown of B-57 sampler, Naval Air Station, Barbers Point, Operation DOMINIC.



DHHL is planning a Barbers Point solar PV facility directly below the area where all of the PFAS foam was used, drilling hundreds of 10 foot deep holes into the ancient coral karst reef instead of using much safer concrete pads for the solar arrays. The massive industrial scale arrays will also be placed around WW-II era high explosive bomb containment structures which were later used to store nuclear weapons during the Cold War.

There is the potential to release a significant amount of previously undisturbed atomic bomb dust washed off of the bomb cloud B-57's using "Forever Chemical" PFAS foams into the underground karst sinkholes, water channels and caves which flow the water into the Ewa shoreline swimming beaches and coral reef ecosystems. Once in the seals, turtles and reef fish ingest the PFAS it will remain forever and transfer into humans who fish and swim in the Ewa Leeward beach and reef areas.



Figure 40. Final check after B-57 decontamination, Naval Air Station, Operation DOMINIC.

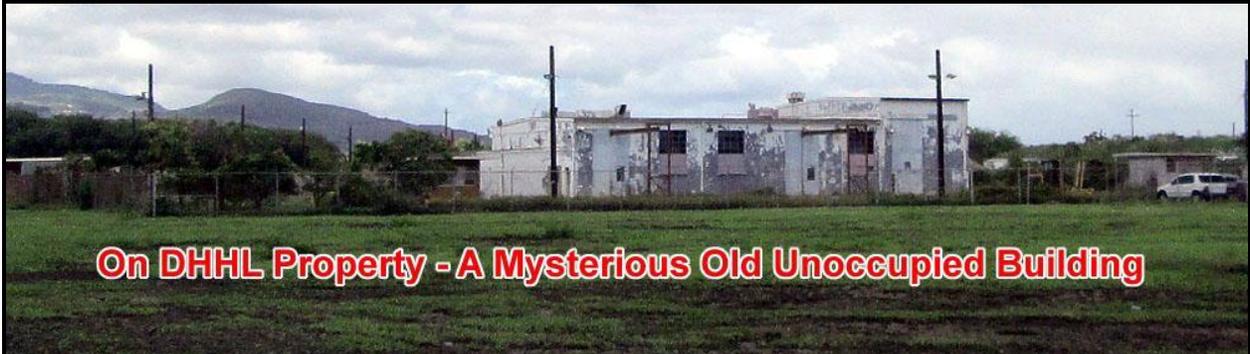
Navy Chemical Dump Located Next To Atomic Bomb Facilities - Threatens Ewa Leeward Reefs, Beaches

Thermal Desorption Treatment of PCB-Contaminated Soil. Former Naval Air Station Barbers Point. Oahu, Hawaii.

https://triadcentral.clu-in.org/user/doc/TPP-BarbersPt-Thermal_Trmt.pdf

The original project EIS documented EPA, UH and water experts expressing strong concerns but that was ignored.

NAS Barbers was the main link between the Pacific Island test facilities and the Treasure Island Naval Base. All these things in the Treasure Island Navy Base story happened at NAS Barbers Point as well.



This is one of the most important buildings in the Cold War Era. It is a National Register eligible structure under several NHPA criteria. The Navy deed of transfer states that it should not be altered or taken down. Almost no one knows about 278's historic significance and its key link to major Pacific atomic bomb tests.

<https://pearl-harbor-blast-zone.blogspot.com/2020/10/nas-barbers-point-site-95-building-278.html>

Bulletin of Atomic Scientists about the Treasure Island cleanup issues

Treasure Island cleanup exposes Navy's mishandling of its nuclear past

<https://thebulletin.org/2014/02/treasure-island-cleanup-exposes-navys-mishandling-of-its-nuclear-past/>

A California Naval base shuttered, and contamination lingers decades later

<https://www.reuters.com/investigates/special-report/usa-military-legacy/>

Observers saw a brilliant white flash and noticeable heat pulse on bare skin.

The fireball was seen in Hawaii also. Brilliant streamers (beta particle auroras) were seen going north and south from Maui

Bluegill Triple Prime, on 26 Oct '62, was the fourth and finally successful launch of this high altitude test using the W-50 warhead in a Mk 4 RV. The 1000 kt warhead detonated at an altitude of 31 miles, approximately 19 miles south-southwest of Johnston Island. This burst occurred low enough in the atmosphere for fireball formation to occur, and observers saw a brilliant white flash and noticeable heat pulse on bare skin. A slightly distorted bright moon-like sphere was seen, yellow at first, then gradually showing green, pink, and violet hues. Blue-purple streamers were formed. A bright glow persisted for 30 minutes, at times bright enough to read a watch face in the dark. The fireball was seen in Hawaii also.

Kingfish was the last THOR launched device which was detonated on 1 November. The detonation occurred at an altitude of 60 miles. The dramatic visual (and other) effects were observed over much of the central Pacific. The explosion appeared as a bright yellow glow, at first circular, but elongating along a south-to-northwest axis. The long axis reached 125 miles after 30 minutes, and eventually reached 185 miles.

US Hydrogen Bomb Tests - Operation Dominic – B-52 Bomb Drop - Barbers Point Nuke Facilities - Restored Color

Shows B-52B 0013 at NAS Barbers Point being loaded with nuclear bomb, Flight code "Cowslip" dropping test weapon. This is the only time US bombers took off from US territory to intentionally drop nuclear bombs.

Operation Dominic 1962, Nuclear test - 1080p ^{HD}

<https://www.youtube.com/watch?v=7gcJvNpgM8M>

NAS Barbers Point B-52 Loads, Takes Off and Drops Mk 36 Atomic Bomb

<https://pearl-harbor-blast-zone.blogspot.com/search/label/B-52%20Bomb%20Drop>

<https://www.youtube.com/watch?v=3gruKqExXTc&list=PUFbzthhT2eRcBpEPc5FPgtQ&index=>

10



Of the hundreds of B-52s built, RB-52B serial No. 52-0013 was one of the few that actually dropped a live nuclear weapon. On Dominic missions, its call sign was Cow Slip Two. 52-0013 is on exhibit at the National Atomic Museum located near Kirtland AFB, N.M.

USAF photos via Walker J. Boyne



Our B-52B was briefly renamed Deterrent I for the Dominic series of nuclear tests in the Pacific in 1962. Shown here with a SAC crew from Sheppard Air Force Base, it had flown to the Pacific for the test series with a crew from Kirtland Air Force Base, which also participated in the tests, as did scientists from Sandia Corporation, the name at that time for Sandia National Laboratories.

1962 “Atomic Rainbow Over Honolulu” was a major public spectator event state-wide

<https://pearl-harbor-blast-zone.blogspot.com/2020/10/1962-atomic-rainbow-over-honolulu-was.html>



LIFE MAGAZINE / JULY 20, 1962

JTF 8 Operation Dominic – B-52 Bomb Drop Task Force

Joint Task Unit 8.4.4 was organized 18 March 1962 at the Naval Air Station, Barbers Point, Hawaii to support the arrival of the advance party from Kirtland Air Force Base, New Mexico. Two B-52 aircraft instrumented specifically for research, development and test work plus two C-130 aircraft instrumented for gathering diagnostic data arrived in the NAS Barbers Point forward area on 2 April 1962.

The test on 30 October named Housatonic was the largest nuclear warhead detonated (8,300 kt) in the Johnston Island area when HMM-364 was present. It was not launched aboard a THOR but rather air delivered by a B-52 and was detonated at an altitude of 12,130 feet. The device was a MK-36 which had a diameter of 56.2 inches, a length of 147.9 inches and weighed 7,139.55 pounds. It was the last air dropped weapon of the U.S. atmospheric test series and was spectacularly successful. It is believed the photograph attached to this paragraph is the detonation of Housatonic.

On April 1962 the first of nine practice missions was flown to the Christmas Island drop site. Four missions were flown with 750 pound practice bombs and three with the dry run mission (DRX) shapes. All missions exactly simulated the actual drop for aircraft crews and ground instrumentation. On 25 April 1962 the first nuclear device was dropped from the B-52 aircraft. The last of 24 devices dropped by the B-52 aircraft was detonated on 11 July 1962.

AIR FORCE Magazine / December 2012

<http://www.airforcemag.com/MagazineArchive/Documents/2012/December%202012/1212bang.pdf>

Smithsonian affiliated, non-profit Museum located in Albuquerque, New Mexico, is restoring its B-52B Stratofortress, serial number 52-0013. She is one of only four B-models in the world on display for public viewing, the first to air drop a hydrogen bomb and the only B-52B left in existence that has dropped atomic weapons - all during testing.

Historic USAF 0013 B-52B Stratofortress Restoration

<https://www.youtube.com/watch?v=xss27xKJLus>

<https://www.indiegogo.com/projects/b52-restoration#/>

B-52B Stratofortress Restoration Project Launch - Jerry Hanks Restoration Project Coordinator

<https://www.youtube.com/watch?v=lrYboSig4kA>

B-52B Stratofortress Restoration Project Launch - Jim Walther, Museum Director

https://www.youtube.com/watch?time_continue=12&v=CwKcxcGKKyE

Marine Corps Operation Dominic HMM-364 support element

<http://www.hmm-364.org/1962/dominic.html>

UNIQUE MISSIONS FLOWN BY THE 552ND AEW&C WING

<http://www.dean-boys.com/dominic/unique-missions.htm>

Blue straw Pictures A1C Billy Reynolds

<http://www.dean-boys.com/dominic/blue%20straw.htm>

OPERATION DOMINIC (BLUE STRAW) - Sometime during the last part of 1961, the 53-0542 takeoff.jpg (17694 bytes) 552nd Wing was tasked with assisting the Department of Energy (Atomic Energy Commission) in testing of the Hydrogen Bomb at a little island called Christmas. Crews were picked and started training for this mission. We had approximately eight weapons directors, two surveillance operators and flight crews to man the three aircraft assigned. By February 1962, all training had been accomplished (survival training and tactical evaluations also had been accomplished). No one knew what this mission pertained to, due to the fact it was highly classified. In the first part of April 1962 the three aircraft were deployed to Hickam AFB, Hawaii.

The Wing had the designation of JTF 8.1.4. Everyone had to go through a records check and be issued a badge. Of course, the flight crews had a blue badge and in that badge was a dosimeter which would turn a different color if

exposed to radiation. One of our aircraft would be the control aircraft and one would be on stand-by until the primary one got airborne. The EC-121 would be the first aircraft airborne and would be on station prior to the other aircraft participating in the testing being released for take off. There were various types of aircraft used in the testing. The main aircraft was the B-52 that carried the nuclear weapon. The B-52 would take off from Barbers Point, Hawaii. We also had the Canberra B-57F with the extended wing so it could fly through the nuclear cloud somewhere around 80,000 feet.



Operation Crossroads was supported by NAS Barbers Point in 1946

<https://pearl-harbor-blast-zone.blogspot.com/search/label/Top%20Secret%20Manhattan%20Project>

Operation Crossroads - on Pacific Islands in 1946 was a Navy sponsored atomic bomb demonstration. The atomic bombs tests brought back a lot of contaminated material to Hawaii and to places like Treasure Island, San Francisco have been dealing with this legacy for a very long time. A lot of Site 95 bomb testing legacy remains classified even today. A little known fact is that the Atomic Energy Commission (AEC) leased land at NAS Barbers Point for supporting Pacific atomic bomb testing.

NAS Barbers Point was part of the MANHATTAN ENGINEER DISTRICT (1945-1946) which grew out of the original Top Secret Manhattan Project that produced two atomic bombs during WW-II. The Barbers Point naval airbase was called "Site 95."

**NAS Barbers Point Site 95, Building 278 Special Weapons
Complex For Atomic Energy Commission and Navy**

<https://pearl-harbor-blast-zone.blogspot.com/2020/10/nas-barbers-point-site-95-building-278.html>

**1962 NAS Barbers Point Operation Dominic B-52 Atomic Bomb
Drop Tests**

<https://pearl-harbor-blast-zone.blogspot.com/2020/10/1962-nas-barbers-point-operation.html>

Good afternoon,

Please find attached a letter sent today from 82 environmental, health and business organizations to President Biden urging the designation of PFOA and PFOS as hazardous substances, a matter of great interest and concern for communities across the country.

Please let me know if you'd like to discuss.

Best,

John E. Reeder

Vice President for Federal Affairs

Environmental Working Group

Washington, DC

July 27th, 2022

The Honorable Joseph R. Biden
President of the United States
The White House
1600 Pennsylvania Ave, NW
Washington, DC 20500

President Biden:

We urge the Biden administration to move swiftly to designate PFOA and PFOS, the two most studied “forever chemicals,” as hazardous substances under CERCLA, better known as the Superfund law.

In October 2021, you announced "accelerated efforts" across the government to tackle PFAS, including plans to propose PFOA and PFOS as hazardous substances. Your announcement reaffirmed your campaign pledge, in *The Biden Plan to Secure Environmental Justice and Equitable Economic Opportunity*, to designate PFOA and PFOS as hazardous substances, recognizing the contamination crisis caused by decades of unregulated releases of these toxic chemicals.

PFAS pollution threatens thousands of communities – including, but not limited to, low-income and communities of color -- who through no fault of their own are confronting health effects and costs of clean up. But the administration has yet to propose designating PFOA and PFOS as hazardous substances. Further delay will pose unacceptable, continued risks to communities across the country.

As you know, the designation of a substance as hazardous does not ban its use, and many such chemicals remain in commerce and are widely used in commercial products. However, coupled with other broad-based actions needed to tackle additional PFAS, the designation of PFOA and PFOS as hazardous substances is an important first step toward helping the EPA hold polluters accountable, encouraging more responsible stewardship, and accelerating efforts to clean up contaminated sites.

We are grateful for your commitment and efforts to address PFAS. We urge you to fulfill this commitment by designating PFOA and PFOS as hazardous substances without delay.

Respectfully,

Alaska Community Action on Toxics
American Association for Justice
American Rivers
American Sustainable Business Network
Breast Cancer Prevention Partners
Buffalo Niagara Waterkeeper
Buxmont Coalition for Safer Water
Center for Environmental Health
Children's Environmental Health Network
Clean Cape Fear
Clean Water Action/Clean Water Fund
Clearya
Climate Crisis Policy
Climate Justice Alliance
Congaree Riverkeeper
Consumer Reports
Defend Our Health
Delaware Riverkeeper Network
Earthjustice
Ecology Center
Endangered Species Coalition
Endocrine Society
Environment America
Environmental Defense Fund
Environmental Health Project
Environmental Justice Task Force Tucson
Environmental Protection Network
Environmental Working Group
Fountain Valley Clean Water Coalition
Freshwater Future
Great Lakes PFAS Action Network
GreenLatinos

Green Science Policy Institute
Greenpeace USA
Gullah/Geechee Sea Island Coalition
Healthy Babies Bright Futures
Highland Dairy
Hispanic Access Foundation
Hispanic Federation
Jacobs Institute of Women's Health
League of Conservation Voters
Learning Disabilities Association of America
Los Angeles Waterkeeper
Massachusetts Breast Cancer Coalition
Merrimack Citizens for Clean Water
Michigan League of Conservation Voters
Military Poisons
Milwaukee Riverkeeper
Moms for a Nontoxic New York
National Center for Health Research
National Wildlife Federation
Natural Resources Defense Council
Need Our Water (NOW)
Newburgh Clean Water Project
Pearl Riverkeeper
Peconic Baykeeper
PfoaProject NY
SC Idle No More/SC Indian Affairs Commission
Linda S. Birnbaum, Scientist Emeritus and Former Director, NIEHS and NTP
Seneca Lake Guardian
Seventh Generation
Sierra Club
Slingshot
Southern Environmental Law Center

Southwest Detroit Environmental Vision
Taproot Earth
Testing for Pease
The Forbes Funds
Three Rivers Waterkeeper
Tip of the Mitt Watershed Council
Toxic-Free Future
Union of Concerned Scientists
Vermont Conservation Voters
Vermont Natural Resources Council
Waterkeeper Alliance
Waterkeepers Chesapeake
We the People of Detroit
West Michigan Environmental Action Council
Westfield Residents Advocating For Themselves (WRAFT)
Wisdom Institute
Women for a Healthy Environment
Women's Voices for the Earth
Zero Waste Washington

To: WHEJAC Members, interested leadership at relevant Federal Agencies, and especially to pertinent leadership on the Interagency Council (IAC)

As a brief acknowledgement with this submittal, my first WHEJAC public meeting was with WHEJAC's inauguration by Vice President Harris on March 30, 2021. And I want to thank you, WHEJAC, for keeping the recording of VP Harris's opening remarks on the WHEJAC website. The inspiration from her presentation endures.

My comments are again about water fluoridation. Please carefully consider the material I am submitting herein, as we are in a watershed historical moment following the media coverage of CDC Director Walensky's recent announcement of her agency's reorganization and resolve to restore public trust in the CDC. The verbiage among federal officials, observed at numerous WHEJAC and NEJAC public meetings, also includes the term **institutional reform**, a paradigm shift long overdue, which Dr. Walensky now honorably and truthfully recognizes, and which she is embracing with transparency. Dr. Walensky is setting the stage as an example for leading some very difficult but needed transformations. A paradigm shift from fluoridation to programs focused on meeting oral health needs is where such reform and transformation are not only desperately needed, but are also fully consistent with and responsive to relevant Presidential Executive Orders, particularly EO13990, which includes the following:

"Section 1. Policy . . . the Federal Government must be guided by *the best science* and be protected by processes that ensure the integrity of Federal decision-making. It is, therefore, the policy of my Administration to listen to the science; to improve public health and protect our environment; to ensure access to clean air and water; to limit exposure to dangerous chemicals and pesticides;" emphasis added.

The best science has come to light in the TSCA trial, noted below and previously referenced, for which the body of evidence continues to grow. Repeatedly at previous WHEJAC and NEJAC public meetings, fluoride's neurodevelopmental toxicity and environmental injustice have been addressed and recorded on the respective dockets. Most importantly because of its relative time sensitivity, I have also promoted an expeditious solution for eliminating the resulting harms to public health imposed by the CDC's Community Water Fluoridation (CWF) program and its environmental injustice.

That solution has rationally evolved as being two-fold for impact and in two steps:

- 1) The first step is for the EPA to respond favorably to the transformational opportunity Mr. Regan will have concerning the current TSCA lawsuit now pending in the court of Judge Edward M. Chen, Federal District Court for the Northern District of California, in San Francisco. The plaintiffs' petition in that case is for the defendant EPA ". . . to compel the initiation of rulemaking pursuant to the Toxic Substances Control Act ("TSCA"), 15 U.S.C. § 2605(a), to prohibit the addition of fluoridation chemicals to drinking water supplies." (The attached [lawsuit.complaint.4-18-17.pdf](#) is a copy of the filing).

The opportunity, specifically, will be for Administrator Regan to grant approval of the anticipated amended petition which will be filed with the EPA following review of additional scientific subject matter in a final report awaiting release from the National Toxicology Program. It is at Judge Chen's request that the anticipated amended petition will be forthcoming, in his words, "to give the EPA a second chance." I have observed Judge Chen to have a remarkable and compelling interest in the scientific evidence supporting the petition, originally filed with the EPA in November 2016, and denied by then Administrator Scott Pruitt in February 2017. Following denial, the petition was converted to the lawsuit then filed with Judge

Chen's court in April 2017. The body of supporting scientific evidence has grown unabated, and continues to do so since the initial filing in 2016; hence Judge Chen's instructions and desire to have that newer material come to light.

A more ambitious option would be for Administrator Regan to reverse Scott Pruitt's February 2017 denial of the original November 2016 petition, denied early in the Trump administration. This action would come under the provisions and directives of EO13990, which also states the following:

Sec. 2. Immediate Review of Agency Actions Taken Between January 20, 2017, and January 20, 2021. (a) The heads of all agencies shall immediately review all existing regulations, orders, guidance documents, policies, and any other similar agency actions (agency actions) promulgated, issued, or adopted between January 20, 2017, and January 20, 2021, that are or may be inconsistent with, or present obstacles to, the policy set forth in section 1 of this order. For any such actions identified by the agencies, the heads of agencies shall, as appropriate and consistent with applicable law, consider suspending, revising, or rescinding the agency actions."

- 2) The second step will be for the CDC to strategically and thoughtfully abandon any and all future promotion of its CWF, and under the umbrella of EO13990 and institutional reform, redirect resources toward promoting oral health in a more as-needed approach. Developing programs for implementation at the local, environmental justice community level could feasibly be modeled after Scotland's proven and highly successful Childsmile program, in stark contrast to the well entrenched and, to date enshrined CWF which mass medicates the public with fluoridated tap water, without informed consent, whether rich or poor, needed or not, white or black, but where only the richer can afford to secure alternative sources for safe drinking water. This action would fully support compliance with EO13990 excerpts provided above and their relevant directives.

The attached pdf files consist of the following:

LULAC Civil Rights Violation.pdf

This file has been submitted previously, and is being provided again to emphasize fluoridation is indeed well known to be an environmental injustice.

EPA_Meta_analysis 2020.png

This is a graphic produced by one of the plaintiffs in the referenced TSCA lawsuit, Brenda Staudenmaier, a degreed environmental engineer employed in the public sector in water treatment and pollution control. The EPA official emblem in the graphic is included only to emphasize that the referenced study was conducted under the auspices of the EPA and its Office of Research and Development.

epa-petition.pdf

Copy of the initial petition filed with the EPA in November 2016.

lawsuit.complaint.4-18-17.pdf

Copy of the lawsuit filed in Federal District Court in April 2017.

comments for WHEJAC August 3, 2022 Final.pdf

This file is a copy of the script I prepared and read in my three minute time allocation as one of the last speakers called on at the meeting on August 3.

Thank you again for this unprecedented opportunity to provide this valuable information.

Respectfully,
John Mueller

EPA Office of Research & Development

A Meta-Analysis of Stressors from the Total Environment Associated with Children's General Cognitive Ability (2020)

“Fluoride was observed to have the greatest increase in impacting cognitive ability (OR = 1.40, $p \leq 0.05$) & it is often reported to affect memory & cause cognitive deficits.”



Fluoride stressed the brain & cognitive abilities at rates of 8 times the average for all toxic element stressors & 13 times lead's effect.

www.ncbi.nlm.nih.gov/pmc/articles/PMC7432904

3-Minute Comment for WHEJAC Public Mtg August 3-4, 2022

Once again thank you, WEJAC members and interested federal officials, for these opportunities to provide valuable public input. I am John Mueller, and I have provided comments at a number of WHEJAC and NEJAC public meetings, as a private citizen activist. My most relevant professional experience supporting my comments about water fluoridation is as a licensed Professional Engineer and former water treatment professional in the public sector, initially with the Santa Clara Valley Water District in San Jose, California, and then with the City of Tulsa's Environmental Operations and later Water and Sewer Department as a Senior Engineer.

I would like to first acknowledge that at the last NEJAC public meeting, on June 22, the Chair of NEJAC, Sylvia Orduño, immediately following my 3-minute comment, was very explicit about certain aspects of my participation in the many NEJAC public meetings, to the extent that she suggested that I could be very helpful in serving the NEJAC in somewhat of a consulting capacity for resolving the fluoridation issue as an environmental injustice. I would very much look forward to that opportunity, but have not yet actively pursued it from my end. I hope to engage with Chair Orduño in the near future.

I recognize that the purpose of public commenting at today's meeting is specifically for "the development of an annual public performance scorecard, and the types of indicators or data that would be useful in a scorecard." This applies to fluoride exposure.

Emerging science has shown common fluoride exposure to be more harmful to public health - comparable to lead - than it is beneficial. Ending the promotion of Community Water Fluoridation (CWF) by the CDC would entail a paradigm shift to promoting more effective alternatives for treating childhood tooth decay, such as Scotland's highly successful Childsmile program. Such programs could be model programs based on criteria described in what Holly Buck, from the Office of Impact and Diversity, presented earlier in today's meeting.

Accordingly, a scorecard for assessing progress in addressing the environmental injustice of fluoridation must necessarily include CDC's database of water utilities participating in its CWF program and their success with more efficient and effective, targeted oral health programs.

EPA Administrator Regan will have an opportunity to address this issue most expeditiously by granting approval of an anticipated petition to be filed with the EPA under provisions of the Toxic Substances Control Act (TSCA), expected sometime in the next few months.

Tooth decay is repairable; but brain damage, we might say, "is a horse of a different color."

Thank you again for these important opportunities.



November 22, 2016

Gina McCarthy, Administrator
Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, NW
Washington, D.C. 20460

Dear Administrator McCarthy:

Pursuant to section 21 of the Toxic Substances Control Act ("TSCA"), 15 U.S.C. § 2620, the Fluoride Action Network, Food & Water Watch, Organic Consumers Association, American Academy of Environmental Medicine, International Academy of Oral Medicine and Toxicology, Moms Against Fluoridation, and undersigned individuals (collectively, "Petitioners") hereby petition the U.S. Environmental Protection Agency to protect the public and susceptible subpopulations from the neurotoxic risks of fluoride by banning the addition of fluoridation chemicals to water.

Under Section 6 of TSCA, EPA is invested with the authority to prohibit the "particular use" of a chemical substance if the use presents an unreasonable risk to the general public or susceptible subpopulations. 15 U.S.C. § 2605(a). EPA has recognized that its authority to regulate chemical substances under TSCA includes the authority to prohibit *drinking water additives*.

EPA should exercise its authority under TSCA to prohibit fluoridation additives because application of the Agency's own *Guidelines for Neurotoxicity Risk Assessment* to the existing database on fluoride shows that (1) neurotoxicity is a hazard of fluoride exposure, and (2) the reference dose that would reasonably protect against this hazard is incompatible with the doses now ingested by millions of Americans in fluoridated areas. In fact, the amount of fluoride now regularly consumed by many people in fluoridated areas *exceeds* the doses *repeatedly* linked to IQ loss and other neurotoxic effects; with certain subpopulations standing at elevated risk of harm, including infants, young children, elderly populations, and those with dietary deficiencies, renal impairment, and/or genetic predispositions.

The risk to the brain posed by fluoridation additives is an unreasonable risk because, *inter alia*, it is now understood that fluoride's predominant effect on tooth decay comes from *topical* contact with teeth, not *ingestion*. Since there is little benefit in *swallowing* fluoride, there is little justification in exposing the public to *any* risk of fluoride neurotoxicity, particularly via a source as essential to human sustenance as the public drinking water and the many processed foods and beverages made therefrom. The addition of fluoridation chemicals to water thus represents the very type of unreasonable risk that EPA is duly authorized to prohibit pursuant to its powers and responsibilities under Section 6 of TSCA, and Petitioners urge the Agency to exercise its authority to do so.

THE PETITIONERS

ORGANIZATIONS:

American Academy of Environmental Medicine (AAEM) was founded in 1965, and is an international association of physicians and other professionals that provides research and education in the recognition, treatment and prevention of illnesses induced by exposures to biological and chemical agents encountered in air, food and water.

Fluoride Action Network (FAN), was founded in 2000 as a project of the American Environmental Health Studies Project, Inc. FAN is an organization of scientists, doctors, dentists, environmental health researchers, and concerned citizens working to raise awareness about the impact of current fluoride exposures on human health.

Food & Water Watch (FWW) is a national non-profit public interest consumer organization, based in Washington, D.C. that works to ensure safe food and clean water. FWW has worked on many emerging technologies that impact our food supply, by educating consumers, the media, and policymakers about the impact on the food system and public health and by calling for appropriate regulation.

The **International Academy of Oral Medicine & Toxicology (IAOMT)** has been dedicated to its mission of protecting public health through the practice of biological dentistry since it was founded in 1984. A worldwide organization of over 800 dentists, physicians, and research professionals in more than 14 countries, IAOMT's mission is accomplished by funding and promoting relevant research, accumulating and disseminating scientific information, investigating and promoting non-invasive scientifically valid therapies, and educating medical professionals, policy makers, and the general public.

Moms Against Fluoridation is a national nonprofit with a mission to increase awareness of the unsafe and unethical practice of artificial water fluoridation in America today.

Organic Consumers Association is a nationwide grassroots public interest organization dealing with issues of food safety, industrial agriculture, and genetic engineering while promoting organic and sustainable agriculture.

INDIVIDUALS:

Audrey Adams, a resident of Renton, Washington (individually and on behalf of her son Kyle Adams); **Jacqueline Denton**, a resident of Asheville, North Carolina (individually and on behalf of her children Tayo Denton and Rumi Denton); **Valerie Green**, a resident of Silver Spring, Maryland (individually and on behalf of her children Joseph Scribner, Paxton Scribner, Savannah Scribner, Talia Scribner, and Violet Scribner); **Kristin Lavelle**, a resident of Berkeley, California (individually and on behalf of her son Neal Lavelle); and **Brenda Staudenmaier** from Green Bay, Wisconsin (individually and on behalf of her children Ko Staudenmaier and Hayden Staudenmaier).

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I. INTRODUCTION

The addition of industrial-grade fluoride chemicals at a concentration of 0.7 to 1.2 mg/L to public water supplies for the purpose of preventing tooth decay is a common practice in the United States, with approximately 200 million Americans now consuming artificially fluoridated water. This practice, known as “water fluoridation,” is hailed as an effective practice by public health institutions in the U.S., but has been rejected by most of continental Europe without any demonstrable adverse effect on childhood caries rates.¹

Water fluoridation began in the U.S. in the 1940s on the premise that fluoride’s primary benefit to teeth comes from *ingestion*. (Fejerskov 2004). The consensus among dental researchers today, however, is that fluoride’s predominant benefit is *topical* not systemic. (NRC 2006, at 13; CDC 2001, at 4; Featherstone 2000). It is also now recognized that fluoride is not an essential nutrient. (NRC 1993, at 30; NRC 1989, at 235). Fluoride does not need to be swallowed, therefore, to prevent any disease, including tooth decay. By contrast, fluoride’s risks to health come from ingestion, including the spectrum of neurotoxic effects discussed below. Accordingly, a reasonable use of fluoride for caries prevention would aim to maximize its topical contact with teeth, while minimizing its ingestion. Topical fluoride products like toothpaste are compatible with this goal; fluoridating water supplies is not.

II. THE TOXIC SUBSTANCES CONTROL ACT (TSCA)

Section 6 of the Toxic Substances Control Act (TSCA) invests EPA with the authority and duty to take certain actions if it determines that “the manufacture, processing, distribution in commerce, use, or disposal of a chemical substance . . . presents an unreasonable risk of injury to health.” 15 U.S.C. § 2605(a). In making this determination, TSCA commands that EPA consider not only risks to the general public, but to “susceptible subpopulation[s]” as well. 15 U.S.C. § 2605(b)(4)(A). Further, TSCA commands that EPA conduct the risk evaluation “without consideration of costs or other nonrisk factors.” *Id.*

If EPA determines that a chemical substance presents an unreasonable risk to the general public or susceptible subpopulation(s), the Agency “shall” take action “to the extent necessary to protect adequately against such risk using the least burdensome requirements.” 15 U.S.C. § 2605(a). The actions that EPA may take include: (1) a complete prohibition on the manufacture, processing, and distribution of the substance or (2) a prohibition on a “particular use” of the substance. 15 U.S.C. § 2605(a)(1)–(3).

EPA’s authority to prohibit and regulate the use of chemical substances under TSCA encompasses drinking water additives. EPA recognized this in its June 12, 1979 Memorandum of Understanding with the FDA, in which the Agency stated unequivocally that it has authority “to regulate direct and indirect *additives to drinking water* as chemical substances and mixtures under TSCA.”² (EPA/FDA 1979)

¹ Tooth decay rates declined precipitously throughout the western world during the second half of the twentieth century, in both the *minority* of western countries that fluoridate water (e.g., Australia, Canada, Ireland, New Zealand, and the U.S.), and the majority of western countries that do not. (Cheng et al. 2007; Pizzo et al. 2007; Neurath 2005; Bratthall et al. 1996; Diesendorf 1986).

² As EPA explained, “[a]lthough Section 3(2)(B) of TSCA excludes from the definition of ‘chemical substance’ food and additives as defined under FFDC, the implicit repeal by the [Safe Drinking Water Act] of FDA’s authority over

EPA may not consider costs when determining whether a risk exists, but it must do so when determining the appropriate course of action to protect against the risk. Specifically, EPA must consider: (1) “the effects of the chemical substance,” (2) “the magnitude of the exposure of human beings,” (3) “the benefits of the chemical substance,” and (4) “the reasonably ascertainable economic consequences of the rule.” 15 U.S.C. § 2605(c)(2)(A). The EPA shall also consider “whether technically and economically feasible alternatives . . . will be reasonably available as a substitute when the proposed prohibition or other restriction takes effect.” 15 U.S.C. § 2605(c)(2)(C).

Finally, EPA is authorized to take action under TSCA, *even if it has authority under other laws to address the risk*, so long as “it is in the public interest” to do so. 15 U.S.C. § 2608(b)(1). In determining whether it is in the public interest to take action under TSCA, EPA “*shall consider . . . all relevant aspects of the risk and a comparison of the estimated costs and efficiencies of the action to be taken under [TSCA] and an action to be taken under such other law to protect against such risk.*” 15 U.S.C. § 2608(b)(2) (emphases added).

Although EPA has certain authorities to regulate fluoride in drinking water under the Safe Drinking Water Act (SDWA), there is an important distinction between TSCA and SDWA that permits EPA to take the requested action under TSCA in a more targeted, efficient, and less expensive manner than would be the case under SDWA. Namely, TSCA permits the EPA to differentiate between fluoride that is *added* to water versus fluoride that is *naturally occurring*. As explained in Section XII below, prioritizing regulatory action against fluoridation *additives* is further justified on policy and scientific grounds. It is therefore in the public interest for EPA to take the requested action under TSCA, instead of SDWA.

III. FLUORIDE IN DRINKING WATER: RECENT REGULATORY BACKGROUND

In 2003, the EPA asked the National Research Council (NRC) to review the scientific merits of EPA’s Maximum Contaminant Level Goal (MCLG) for fluoride, which then and now is set at 4 mg/L. In response, the NRC reviewed the existing research on fluoride toxicity and concluded, in March 2006, that the MCLG is not protective of public health and should be lowered. (NRC 2006). The NRC’s conclusion was based on fluoride’s adverse effects on bone and teeth, but the NRC also raised numerous concerns about the potential for fluoride to cause other systemic harm, particularly to the nervous and endocrine systems.

With respect to the nervous system, the NRC concluded: “On the basis of information largely derived from histological, chemical, and molecular studies, it is apparent that fluorides have the ability to interfere with the functions of the brain.” (NRC 2006, at 222). The NRC’s conclusion about fluoride’s interference with the brain rested primarily on its review of animal studies, since—at the time of NRC’s review—few human studies were available. The situation today, however, is much different as many studies linking fluoride exposure to cognitive deficits in humans have now been published. The number of human studies published subsequent to the NRC review that have found significant relationships between fluoride and adverse cognitive outcomes (n = 46) dwarfs the number of such studies that were available to the NRC (n = 5).³

drinking water enables EPA to regulate direct and indirect additives to drinking water as chemical substances and mixtures under TSCA.” (EPA/FDA 1979)

³ The 46 post-NRC human cognitive studies are cited in Appendix A. The five human cognitive studies that NRC cited are: Li et al. (1995); Zhao et al. (1996); Lu et al. (2000); Xiang et al. (2003a,b); and Qin et al. (1990).

The evidence linking fluoride to neurotoxicity in humans, therefore, is far more compelling today than it was when NRC published its review. Indeed, in 2014, fluoride was added to the list of chemicals “*known to cause developmental neurotoxicity in human beings*” in a review published by *Lancet Neurology*. (Grandjean & Landrigan 2014, at 334, Tbl 2). Only 12 chemicals are on this list.

It has been 10 years since the NRC concluded that the MCLG for fluoride be lowered, but the EPA has yet to do so. Further, despite the voluminous post-2006 research on neurotoxicity, and despite the Safe Drinking Water Act’s mandate that EPA protect against “known or *anticipated* adverse effects,”⁴ EPA’s Office of Water (EPA OW) has indicated that it will *not* be considering neurotoxicity as an endpoint of concern when promulgating the new MCLG. Specifically, in its December 2010 risk assessment of fluoride’s non-cancer effects, EPA OW established a reference dose for fluoride based solely on severe dental fluorosis, and declined to add an uncertainty factor to account for the neurotoxicity hazard. (EPA 2010, at 3 & 106). EPA OW justified this decision on the grounds that NRC’s 2006 review did not draw firm conclusions about the public health relevance of fluoride neurotoxicity. (EPA 2010, at 106). Nowhere in EPA OW’s risk assessment, however, did it account for the neurotoxicity research published subsequent to NRC’s review.

The cavalier manner in which EPA’s OW dismissed the evidence of fluoride neurotoxicity stands in stark contrast to EPA’s own *Guidelines for Neurotoxicity Risk Assessment* [hereafter *Guidelines*] that EPA has stated it “*will follow in evaluating data on potential neurotoxicity associated with exposure to environmental toxicants.*” (EPA 1998, at 1). Petitioners submit that application of EPA’s *Guidelines* to the existing database for fluoride shows that neurotoxicity is a hazard of fluoride exposure, that the weight of evidence indicates neurotoxicity is a more sensitive endpoint of fluoride exposure than severe dental fluorosis,⁵ and, further, that the reference dose for fluoride that will protect the public and susceptible subpopulations against neurotoxicity is incompatible with the doses now ingested in fluoridated areas.

IV. FLUORIDE’S NEUROTOXICITY IS SUPPORTED BY OVER 180 STUDIES PUBLISHED SINCE NRC’S 2006 REVIEW

One of the striking features of the research on fluoride neurotoxicity is the large quantity of studies—animal, cellular, *and* human—that have reported an effect. In a recent review of developmental neurotoxins by EPA scientists, only 22% of suspected neurotoxins were found to have *any* supporting human data. (Mundy et al. 2015, at 25). The EPA team thus characterized chemicals, including fluoride, whose suspected neurotoxicity is backed by human data, as “gold standard” chemicals that warrant prioritization. (Mundy et al. 2015, at 27). In the case of fluoride, not only is there human data, the data is so extensive that fluoride has been classified alongside lead, mercury, and PCBs as one of only 12 chemicals “*known to cause developmental neurotoxicity in human beings.*” (Grandjean & Landrigan 2014, at 334, Tbl 2). The existence of so many human studies on fluoride neurotoxicity highlights the urgent need for a diligent risk assessment, per EPA’s *Guidelines*, to ensure that the general public, and sensitive subpopulations, are not ingesting neurotoxic levels.

⁴ 42 U.S.C. § 300g-1(b)(4)(A).

⁵ The *Guidelines* state that: “If data are considered sufficient for risk assessment, and *if neurotoxicity is the effect occurring at the lowest dose level* (i.e., the critical effect), an oral or dermal RfD or an inhalation RfC, based on neurotoxic effects, is then derived.” (EPA 1998, at 2)

Unlike EPA's 2010 risk assessment, a diligent evaluation of fluoride's neurotoxicity would consider the voluminous data that has been released since the NRC published its review in March 2006. Towards this end, Petitioners have attached an exhaustive list of human, animal, and cell studies of fluoride's neurotoxicity that have become available since NRC's review.⁶

In total, Petitioners have identified 196 published studies that have addressed the neurotoxic effects of fluoride exposure subsequent to the NRC's review, including 61 human studies, 115 animal studies, 17 cell studies, and 3 systematic reviews.

The post-NRC human studies include:

- 54 studies investigating fluoride's effect on cognition, including but not limited to IQ, with all but 8 of these studies finding statistically significant⁷ associations between fluoride exposure and cognitive deficits.⁸ (Appendix A)
- 3 studies investigating fluoride's effect on fetal brain, with each of the 3 studies reporting deleterious effects. (Appendix B)
- 4 studies investigating fluoride's association with other forms of neurotoxic harm, including ADHD, altered neonatal behavior, and various neurological symptoms. (Appendix C)

The post-NRC animal studies include:

- 105 studies investigating fluoride's ability to produce neuroanatomical and neurochemical changes, with all but 2 of the studies finding at least one detrimental effect in the fluoride-treated groups. (Appendix D)
- 31 studies investigating fluoride's effect on learning and memory, with all but one of the studies finding at least one deleterious effect in the fluoride-treated groups. (Appendix E)
- 18 studies investigating fluoride's impact on other parameters of neurobehavior besides learning and memory, with all but one of the studies finding effects. (Appendix F)

The post-NRC cell studies include:

- 17 studies, including 2 studies that investigated and found effects at fluoride levels that chronically occur in the blood of Americans living in fluoridated communities. (Appendix G)

⁶ Included among these studies are Chinese language studies that were originally published in Chinese journals prior to 2006 but were not translated and made available in the U.S. until after the NRC's review. Excluded from these studies are those that are only available in abstract form, and animal/cell studies that have not yet been published and/or translated into English.

⁷ In 4 of the 8 studies not finding statistically significant associations, the IQs of the children in the high-fluoride area were lower than in the low-fluoride area. (Eswar et al. 2011; Yang et al. 2008; Fan et al. 2007; Zhang et al. 1998) The 4 studies that did not find any association between fluoride exposure and IQ, significant or otherwise, are: Broadbent et al. 2015; Kang et al. 2011; He et al. 2010; and Li et al. 2010.

⁸ Petitioners are aware of two unpublished fluoride/IQ studies from Mexico, one which reports a significant relationship between prenatal fluoride exposure and reduced IQ (water F = 3.1 mg/L; urine F = 2.0 mg/L) (Rocha Amador et al. 2016), and one which reports no association between childhood IQ and low-level prenatal and postnatal exposures (Thomas 2014). The Thomas study failed to detect an association between IQ and urinary/serum fluoride concentrations in a population with average urinary and serum fluoride levels among pregnant women of 0.89 mg/L and 0.02 mg/L, respectively, and average urinary fluoride concentrations among children of 0.64 mg/L. The Thomas study, however, failed to find a significant correlation between urinary and serum fluoride levels, which raises questions about whether the study's spot-sample testing method reliably reflected the chronic fluoride intake among the cohort.

In addition to the above studies, Petitioners are submitting three post-NRC systematic reviews of the literature, including two that address the human/IQ literature, and one that addresses the animal/cognition literature. (NTP 2016; Choi et al. 2012; Tang et al. 2008).

V. FLUORIDE POSES NEUROTOXIC RISKS AT LEVELS RELEVANT TO U.S. POPULATION

A frequent claim made by those who continue to promote fluoridation is that the doses of fluoride associated with neurotoxicity in humans and animals so vastly exceed the levels which Americans drinking fluoridated water receive as to be entirely irrelevant. In support of this claim, proponents of fluoridation often point to the *highest* levels that have been linked to neurotoxicity, while ignoring the *lowest* levels (and even the *typical* levels) that have been associated with harm.⁹ This focus on the *highest* levels that cause harm as the starting point for analysis, rather than the lowest levels, clashes with standard tenets of risk assessment, including EPA's *Guidelines*, where the starting point for risk characterization analysis is to determine the *Lowest* Observable Adverse Effect Level (LOAEL) or No Observable Adverse Effect Level (NOAEL).¹⁰

A. Fluoride Repeatedly Linked to Reduced IQ at “Safe” Water Fluoride Levels

Contrary to the oft-repeated claim that fluoride neurotoxicity is only found at irrelevantly high doses, the existing studies of fluoride-exposed human populations have consistently found neurotoxic effects at water fluoride levels well below the current MCLG. To help clarify this issue, we examined the IQ studies that were included in the meta-review by Choi, et al. (2012). Proponents of fluoridation have dismissed the relevance of the Choi meta-review on the grounds that the IQ studies it included were in communities with fluoride levels that ranged as high as 11 ppm. As can be seen in the following table, however, the majority of waterborne fluoride studies (i.e., 13 of 18)¹¹ that Choi reviewed included communities with fluoride levels below the 4 mg/L MCLG. Further, each of the 13 studies that investigated the effect of fluoride levels below 4 mg/L (average F = **2.3 mg/L**) found these communities to have a lower average IQ than the control (average reduction = 6.3 IQ points), with the difference reaching statistical significance in 10 of the 13 studies.¹²

⁹ Another common misconception is that the endemic fluorosis/IQ studies prove the safety of fluoridated water because the control populations in these studies often have 0.7 to 1.0 mg/L fluoride in their water. Using areas with 0.7 to 1.0 mg/L as the *control*, however, says nothing about the safety of these levels since they are not compared against communities with *lower* fluoride levels.

¹⁰ As the *Guidelines* note, “Typically, estimates of the NOAEL/LOAEL are taken from the *lowest* part of the dose-response curve associated with impaired function or adverse effect.” (EPA 1998, at 58). Similarly, when the Benchmark Dose (BMD) approach is utilized instead of the NOAEL/LOAEL methods, EPA's point of departure is the low end of the dose-response curve, not the high end.

¹¹ We excluded any waterborne-fluoride exposure studies that did not report the water fluoride levels in the endemic fluorosis area(s). We excluded Li et al. (2010) because it did not compare a high fluoride community against a low-fluoride community, but simply looked at whether children with dental fluorosis in the high-fluoride community (2.5 mg/L) had lower IQ than children without dental fluorosis in the same community. We treated the Wang et al. 2001 and Yang et al. 1994 papers as a single study because it is apparent from the IQ data in the two papers that they are based on the same underlying IQ study. For the 18 qualifying studies, we reviewed the manuscripts to determine the lowest average fluoride concentration in each of the studies that was associated with reduced IQ. In studies with multiple exposure groups (e.g., Yao et al. 1996; Yao et al. 1997), we selected the lowest exposure group that had a reduction in IQ. For studies that only provide a range of fluoride levels for a given exposure group, we selected the midway point in the range to represent the average fluoride concentration for the group.

¹² As set forth in the accompanying table, one of the two studies that failed to find a statistically significant difference in average IQ (Wang et al. 2001) found an “obvious” increase in the rate of children with IQ scores lower than 80 (36.7% vs. 16.7%).

Study	Water F Level	IQ Change
Zhang et al. 1998	0.8 mg/L	-2.1 ^g
Lin et al. 1991	0.9 mg/L ^Ω	-7.0 ^a
Xu et al. 1994	2.0 mg/L ^Ω	-5.6 ^d
Yao et al. 1996	2.0 mg/L	-3.6 ^d
Yao et al. 1997	2.0 mg/L	-5.1 ^d
Pourleslami et al. 2011	2.4 mg/L	-6.4 ^a
Xiang et al. 2003	2.5 mg/L	-8.2 ^d
Seraj et al. 2006	2.5 mg/L	-11.0 ^b
An et al. 1992	2.7 mg/L	-7.9 ^f
Hong et al. 2001	2.9 mg/L ^Ω	-7.2 ^d
Wang 2001/Yang 1994	3.0 mg/L	-5.0 ^h
Lu et al. 2000	3.2 mg/L	-10.9 ^e
Fan et al. 2007	3.2 mg/L	-2.3 ^g
Zhao et al. 1996	4.1 mg/L	-7.5 ^c
Chen et al. 1991	4.6 mg/L	-3.8 ^d
Wang et al. 1996	4.8 mg/L	-5.6 ^a
Wang et al. 2006	5.5 mg/L	-4.1 ^d
Wang et al. 2007	8.3 mg/L	-6.0 ^a

^a p<0.05; ^b p=0.025; ^c p<0.02; ^d p<0.01; ^e p<0.005; ^f Statistical significance not reported; ^g Not statistically significant; ^h Not statistically significant when analyzed in terms of average IQ, but “obvious” difference seen when analyzed in terms of percentage with low IQ; ^Ω High-fluoride + low-iodine versus low-fluoride + low-iodine; ^{||} These two papers appear to be the same study.

Additional studies finding reduced IQ in communities with less than 4 mg/L have become available in the years since Choi’s review, including Sudhir et al. 2009 (**0.7 to 1.2 mg/L**); Zhang S. et al. 2015 (**1.4 mg/L**), Das & Mondal 2016 (**2.1 mg/L**), Choi et al. 2015 (**2.2 mg/L**), Sebastian & Sunitha 2012 (**2.2 mg/L**); Trivedi et al. 2012 (**2.3 mg/L**), Khan et al. 2015 (**2.4 mg/L**); Nagarajappa et al. 2013 (**2.4 to 3.5 mg/L**), Seraj et al. 2012 (**3.1 mg/L**), and Karimzade et al. 2014a,b (**3.94 mg/L**). Another study (Ding et al. 2011), which did not fit within Choi’s dichotomous exposure criteria, found reduced IQ in an area with fluoride levels ranging from **0.3 to 3 mg/L**. In total, there are now 23 studies reporting statistically significant reductions in IQ in areas with fluoride levels currently deemed safe by the EPA (less than 4 mg/L).¹³

B. Fluoride Linked to Cognitive Deficits at Levels of Individual Exposure Seen in Western Fluoridated Populations

Although the water fluoride levels associated with IQ reductions are modestly higher than the levels currently used in artificially water fluoridation programs, it is important to distinguish between the *concentration* of fluoride in a community’s water supply and the *dose* of fluoride that an individual ingests. For example, in rural China (where most of the IQ studies have been conducted), fluoridated toothpaste is rarely used, with less than 10% of children using any fluoride toothpaste at all.¹⁴ By contrast, in the United States, over 95% of toothpastes are fluoridated and research shows that toothpaste can contribute more fluoride to a child’s daily intake than fluoridated water. (CDC 2013c; Zohoori et al. 2013, Zohoori et al. 2012; Levy et al.

¹³ The 23 studies include the 10 studies listed in Table 1, the 11 studies listed in the paragraph above, and the studies by Eswar et al. 2011 and Shivaprakash et al. 2011.

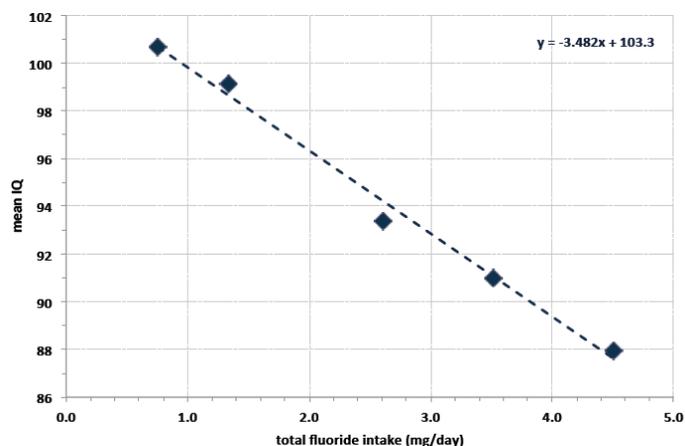
¹⁴ According to a 1996 national oral health survey in China, 75% of 12-year-old children use toothpaste, and of the children who use toothpaste, only 11% use fluoride-containing varieties. (Zhu et al. 2003, at 291, Tbl 1.)

1999). As noted by a review in the *Journal of Public Health Dentistry*, “Virtually all authors have noted that some children could ingest more fluoride from dentrifice alone than is recommended as a total daily fluoride ingestion.”¹⁵ (Levy and Guda-Chowdhury 1999, at 216-17). The abundance of fluoridated toothpaste in the U.S., versus its relative scarcity in rural China, will therefore lessen the difference in total daily fluoride intake between these populations. In fact, as set forth below, available evidence suggests that the (i) daily fluoride doses, (ii) urine fluoride levels, (iii) serum fluoride levels, and (iv) dental fluorosis levels associated with IQ reductions in the Chinese studies are seen in children and adults in western countries living in fluoridated areas. Each of these four metrics of fluoride exposure provide a more direct assessment of individual fluoride exposure than water fluoride concentration, and are thus more probative for risk assessment purposes.

(i) Daily Fluoride Intake

The overlap between the daily fluoride intake associated with significant IQ loss in China and the daily doses American children now receive is highlighted by the recent studies from Wang et al. (2012) and Das et al. (2016). In the study by Wang, researchers investigated the impact of total daily intake of fluoride on IQ among the same group of 512 rural Chinese 8-to-13 year old children studied by the Xiang team in 2003. (Xiang et al. 2003a,b). As the following table shows, the Wang study found a clear dose response relationship between daily fluoride dose and reduced IQ.

FIGURE 1: Relationship Between Daily Fluoride Dose and IQ
(SOURCE: Wang et al. 2012, Tbl. 4)



Wang found that a daily intake of just 2.61 mg F/day was associated with a large, statistically significant 7.28-point drop in average IQ. Assuming an average weight of 32 kg,¹⁶ a daily intake

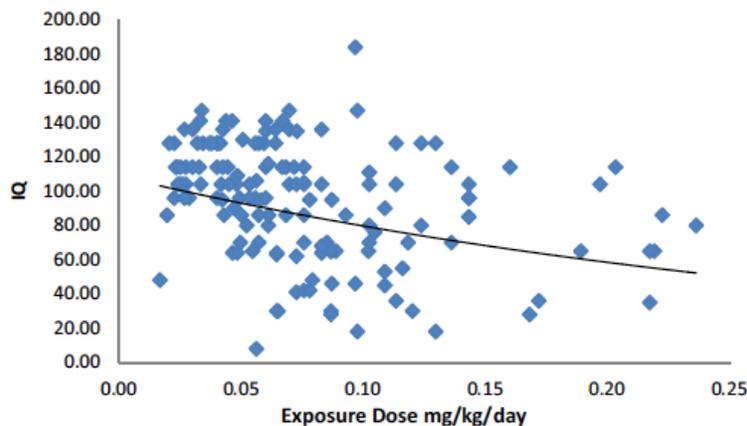
¹⁵ Petitioners recognize that the FDA has jurisdiction over fluoride toothpaste, but any assessment of the safe level of a contaminant in drinking water cannot be conducted in a vacuum, and must consider the additive effect of waterborne exposures with identifiable non-water sources of exposure. When considering the neurologic safety of fluoridated water, therefore, it is critical to consider the aggregate dose of fluoride in fluoridated communities from all sources, including toothpaste. EPA has recognized this principle in its “relative source contribution” analyses, which the EPA OW conducts when calculating the drinking water equivalent level (DWEL) of a reference dose. EPA (2016). TSCA also specifically contemplates consideration of aggregate and sentinel exposures in Section 6 risk evaluations. See 15 U.S.C. § 2605(b)(4)(F).

¹⁶ The authors did not provide data on the average weight of the children in the study, and we could not find data on the average weight of rural Chinese children between the ages of 8 and 13. We did, however, find published data on

of 2.61 mg would provide a dosage of approximately **0.08 mg/kg/day**,¹⁷ which is *lower* than the *average* daily intake (**0.087 mg/kg/day**) for non-nursing infants in the United States, as estimated by the NRC, and just two times greater than the *average* daily dose for 8-12 year old American children.¹⁸ (NRC 2006, at 65, Tbl. 2-13). Moreover, recent research has found that 10 to 15% of children under the age of 6 ingest over 0.05 mg/kg/day *from toothpaste alone*, with some children ingesting as much as **0.159 mg/kg/day** from this single source. (Strittholt et al. 2016 at 70 tbl. 2; Zohoori et al. 2012 at 418 tbl 2; Zohoori et al. 2013 at 460 tbl 1; Levy & Guha-Chowdhury 1999 at 217 tbl 3). In one study, published by Proctor & Gamble scientists (Strittholt et al. 2016), 5% of pre-schoolers were found to ingest at least 0.49 mg fluoride per brushing, which, at two brushings per day, will produce a daily dosage of 0.07 mg/kg/day from toothpaste alone for the average-weighting 2-year-old. (CDC 2000a,b). Other studies are consistent with these estimates. (Oliveria et al. 2007; Bentley et al. 1999; Levy 1993; Naccahe et al. 1992). For the many pre-school children ingesting these dosages from toothpaste, the consumption of fluoridated water will readily push them over the daily dosage (0.08 mg/kg/day) associated with sharp reductions in IQ among rural Chinese children.

Finally, as with other forms of fluoride toxicity, the potential for fluoride neurotoxicity is magnified among children with suboptimal nutrient intake. (Sun et al. 2016; Ge et al. 2011; Hong et al. 2008; Ge et al. 2005; Wang et al. 2004; Ekambaram & Paul 2002; Xu et al. 1994; Lin et al. 1991; Ren et al. 1989; Guan et al. 1988). This is highlighted by the recent study by Das and Mondal which assessed the relationship between fluoride intake and IQ among a population with a high prevalence of underweight children suggestive of an area with pervasive malnutrition. In this population, Das and Mondal confirmed a significant correlation between total fluoride intake and reduced IQ ($r = -0.343, p < 0.01$), as plotted in the following figure:

FIGURE 2: Relationship Between Total Daily Intake and IQ
(SOURCE: Das & Mondal 2016, Fig. 6)



the weight of rural Chinese children ages 0 to 7, as well as average weight data on U.S. children between the ages of 2 and 20. (Li et al. 2011; CDC 2000a,b) A comparison of these two datasets shows that rural Chinese children weigh approximately 4 kg less than U.S. children (18.7 kg vs. 23 kg) between the ages of 6 and 7. We thus determined the average weight of 8-to-13 year old rural Chinese children by calculating the average weight of 8-to-13 year old U.S. from the CDC growth charts (=36 kg) and subtracting 4 kg (=32 kg).

¹⁷ It bears noting that 0.08 mg/kg/day is EPA's new reference dose for fluoride, which the Agency established to protect solely against severe dental fluorosis (without the protection of a single uncertainty factor to account for potential neurotoxic risks). (EPA 2010)

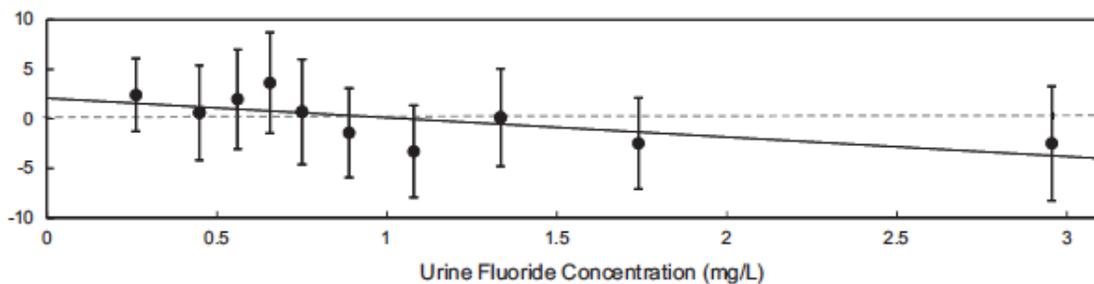
¹⁸ A recent national analysis of urinary fluoride levels in the United Kingdom UK concluded that over 65% of adults living in fluoridated areas consume more than 0.057 mg/kg/day. (Mansfield 2010)

Notably, Das and Mondal found a sharp 15-point drop in IQ among underweight children with *mild* dental fluorosis who were consuming average total daily fluoride exposures of just **0.06 mg/kg/day**. (Das & Mondal 2016, at 218, Tbl. 3). As discussed above, this is a dose that many infants and children in the U.S. are estimated to exceed.

(ii) Urine Fluoride Level

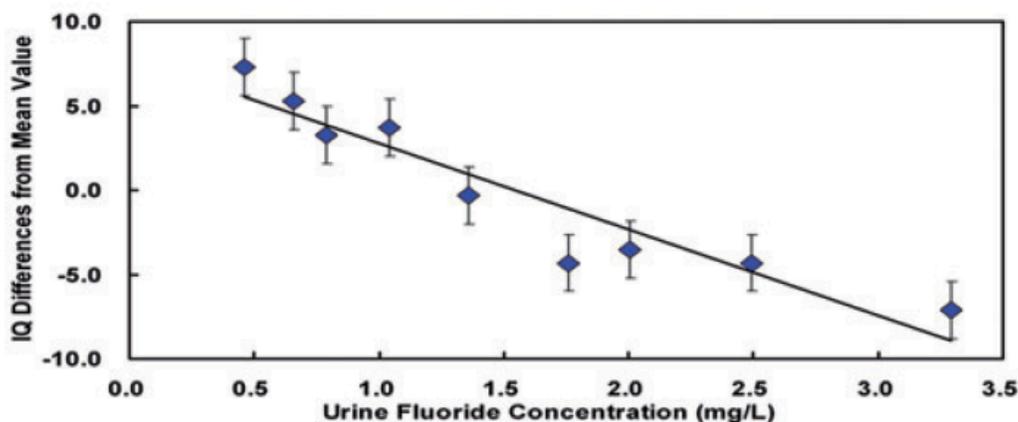
Many of the studies on fluoride and IQ have measured the concentration of fluoride in children's urine as a marker of individual fluoride exposure. As summarized in a 2011 review, these studies have repeatedly found significant, often large reductions in IQ when the average urinary fluoride level exceeds 2.5 mg/L, (Spittle 2011), and multiple regression analyses have repeatedly found that increased urinary fluoride correlates with reduced IQ, (Das et al. 2016; Zhang S. et al. 2015; Wang et al. 2007), even when controlling for other key risk factors. (Rocha Amador et al. 2009). While urinary fluoride levels exceeding 2.5 mg/L present a clear risk for neurotoxicity, recent studies have also found decrements in IQ at urinary fluoride concentrations well below this level. Most notable in this regard is the study by Ding et al., which examined the correlation between urinary fluoride and IQ among children with urinary fluoride levels ranging from just 0.25 mg/L to 3 mg/L. As shown in the following figure, a clear dose response trend was found within this urinary fluoride range ($p < 0.0001$), with the downward trend becoming apparent at roughly 1 mg/L. When adjusted for age, each 1 mg/L increment in urinary fluoride correlated with an average drop of 0.59 IQ points ($p < 0.0001$).

FIGURE 3: Relationship Between Urinary Fluoride and IQ
(SOURCE: Ding et al. 2011, Fig. 2)



The dose-response trend found by Ding is consistent with more recent data published by Zhang et al. 2015, which is displayed in the following figure. As can be seen, the Zhang study found a clear drop in IQ at urinary fluoride levels between 0.5 and 1.5 mg/L.

FIGURE 4: Relationship Between Urinary Fluoride and IQ
(SOURCE: Zhang S. et al. 2015, Fig. 1)



More recently, researchers have investigated the prevalence of cognitive impairment among elderly individuals living in an endemic fluorosis region of China. (Li et al. 2016). The researchers found a very high prevalence of cognitive impairment (81.2%) in the fluorosis region, and, in a case-control analysis, found a significantly elevated urinary fluoride level (2.5 mg/L vs. 1.5 mg/L, $p < 0.05$) in the cognitive impairment group.¹⁹ (Li et al. 2016, at 57, Tbl. 3). The data from this case-control analysis is presented in the following table:

TABLE 2: Urinary Fluoride & Cognitive Impairment in Elderly
(SOURCE: Li et al. 2016, Tbl 3)

Characteristics ^a	Normal group (n=38)	Cognitive impairment group (n=38)	P value
Male/female	26/12	26/12	
Age (years)	64.95±4.60	65.05±4.40	0.920
MMSE score	27.79±0.96	21.50±4.37	0.000
Total daily water fluoride intake(mg ^b)	2.23±2.23	3.62±6.71	0.228
Urinary fluoride(mg/L ^b)	1.46±1.04	2.47±2.88	0.046
fluorosis score ^b	0.74±0.98	1.29±1.01	0.018
Serum Hcy(μmol/L ^b)	19.97±8.88	20.14±9.29	0.934

^a Values are n/n for gender and mean±SD for other indices.

^b The original values were log-transformed before comparison. The difference between two groups was tested using Student's t test.

Although there is a paucity of published data on urinary fluoride levels in the United States, a study from England found that the average urinary fluoride level among 88 adults living in a fluoridated area was 1.28 mg/L, with 16% of the tested individuals having over 2 mg/L, and 6%

¹⁹ A clear dose-response relationship between urinary fluoride and cognitive impairment was not detected in the non-case control component of Li et al.'s analysis, although urinary fluoride was found to be elevated in the population with severe cognitive impairment.

of individuals having over 3 mg/L.²⁰ (Mansfield 1999, at 28, Tbl. 1). These levels overlap those that have been associated in endemic fluorosis areas with both reduced IQ in children and cognitive impairment in the elderly. (Li et al. 2016; Zhang S. et al. 2015; Ding et al. 2011). A more recent study from Canada found that 5 percent of *children* had ≥ 1.3 mg/L fluoride in their urine, which is well within the range of urinary fluoride levels associated with reduced IQ in the Ding and Zhang studies. (Saravanabhavan et al. 2016). A separate Canadian study found that the *average* urinary fluoride concentration in fluoridated areas was 0.76 mg/L, which was almost twice the concentration (0.47 mg/L) found in non-fluoridated areas. (McLaren 2016).

(iii) Serum Fluoride Level

In 2011, Xiang et al. published a paper which assessed the relationship between IQ and serum fluoride levels in the same group of 512 children studied in Wang’s daily dose analysis discussed above. As with the daily dose analysis, the authors found a significant dose-response relationship between serum fluoride level and reduced IQ. As shown in the following table, children with just 0.05 to 0.08 mg/L fluoride in their serum had a statistically significant 4.2-point drop in IQ when compared against children with less than 0.05 mg/L.²¹

TABLE 3: Association Between Serum Fluoride and Children’s IQ
(SOURCE: Xiang et al. 2011, Tbl 2)

Serum fluoride level quartiles	N	Mean IQ	SD IQ	p ^b	IQ<80 (%)	p ^c	OR (95% CI) for IQ<80
Q1 and Q2 (<0.05 mg/L)	259	100.1	13.4	<0.001	7.0		1
Q3 (0.05–0.08 mg/L)	126	95.9	13.7		15.1	0.004	2.22 (1.42–3.47)
Q4 (>0.08 mg/L)	127	92.1	13.4		17.3		2.48 (1.85–3.32) p trend<0.001 ^d

^aAdjusted for age and gender using Logistic regression analysis. The data from two villages were combined.

^bNOVA.

^cChi-square test.

^dTests of linear trend were computed using ordinal scoring.

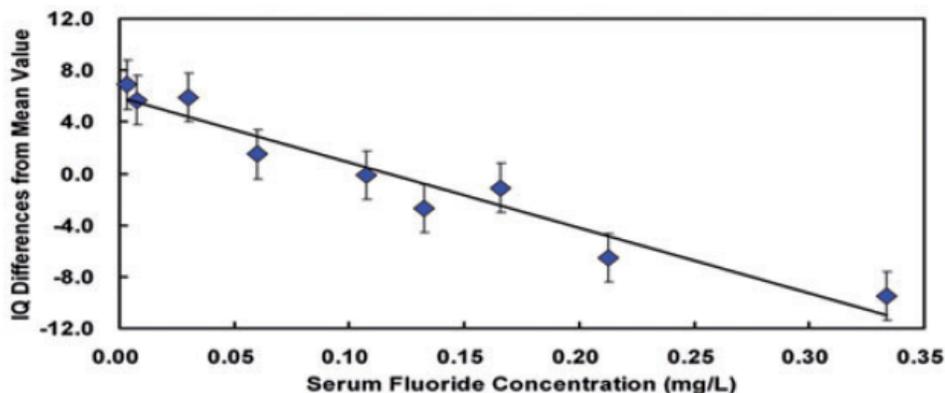
Abbreviations: CI Confidence Interval, IQ Intelligence Quotient, OR Odds Ratio, SD Standard Deviation.

The Xiang team’s findings are consistent with the findings of other recent studies, including Guo Z. et al. (2008), which found impairment in neurobehavioral function among adult industrial workers with average serum fluoride levels of 0.066 mg/L, and Zhang S. et al. (2015), which found significant reductions in IQ among children with just over 0.05 mg/L fluoride in their blood when compared to children with the lowest levels. The Zhang study plotted the serum data in the following figure:

²⁰ These urinary fluoride levels exceeded those that were found among individuals (n = 165) living in non-fluoridated areas. The average urinary fluoride level in the non-fluoridated areas was 0.96 mg/L; with 8% having more than 2 mg/L; and 4% having more than 3 mg/L. (Mansfield 1999, at 28, Tbl. 1)

²¹ As the authors emphasize, their finding of a 4-point IQ drop in children with more than 0.05 mg/L fluoride in their serum does *not* mean that serum levels lower than 0.05 mg/L are safe.

FIGURE 5: Relationship Between Serum Fluoride and IQ
(SOURCE: Zhang S. et al. 2015, Fig. 1)



To put these serum fluoride levels in the context of U.S. exposures, typical serum fluoride levels for adults in the U.S. have been stated to range from about 0.01 to 0.076 mg/L (0.5 to 4 uM/L). (CDC 2014, at 2; see also Kissa 1987). In one study of infants, an average concentration of 0.08 mg/L was found among healthy 4-to-6 month old infants, while an average concentration of 0.10 to 0.18 mg/L was found among 4-to-18 month old infants receiving peritoneal dialysis. (Warady et al. 1989). A study by Ekstrand found that infants ingesting 0.25 mg in supplement form have spikes in their blood ranging as high as 0.092 mg/L, and averaging 0.063 mg/L. (Ekstrand 1994, at 159 tbl 3). Ekstrand's study did not measure the impact of ingesting fluoride in the form of infant formula reconstituted with fluoridated water, but the resulting daily peaks in serum fluoride levels may be comparable, since Ekstrand estimates that infants consuming fluoridated formula receive doses (up to five times a day) that are comparable to a supplement (i.e., 20-30 ug/kg of fluoride per formula feeding vs. 32 ug/kg per supplement). (Ekstrand 1994, at 162).

While there has long been a paucity of serum fluoride data available for children in the U.S., a recent NHANES survey found that roughly 1 in 200 American children between the ages of 3 to 19 have serum fluoride levels exceeding 0.04 mg/L. (NHANES 2016). Since there are approximately 70 million American children in this age range, (US Census Bureau 2011), the NHANES data indicates that approximately 350,000 American children have serum fluoride levels in the approximate range associated with overt neurotoxic effects.

(iv) Dental Fluorosis Level

EPA OW's 2010 risk assessment of the non-cancer effects of fluoride rests on the implicit assumption that *severe* dental fluorosis is the most sensitive adverse endpoint of fluoride exposure. This assumption, however, is at odds with a number of studies which have found significant associations between fluoride exposure and cognitive deficits among children with *non-severe* forms of fluorosis. Most notably, the study by Ding et al. (2011) found a dose-dependent relationship between reduced IQ and urinary fluoride concentration in a population where severe dental fluorosis was *completely absent*. The Ding study thus suggests that the doses of fluoride that impair cognitive ability are lower than the doses that cause severe fluorosis. Other recent studies have found impairment in cognitive abilities among children with *mild* fluorosis, *moderate* fluorosis, and *moderate/severe* fluorosis when compared with children with no fluorosis, thus suggesting that the doses of fluoride associated with the milder forms of

fluorosis are sufficient to impair brain development.²² (Das & Mondal 2016 at tbl 3; Choi et al. 2015; Li et al. 2009; Khan et al. 2015; Shivaprakash et al. 2011; Sudhir et al. 2009 at tbl 3).

Consistent with the above studies of human populations, studies of rodents have repeatedly found significant impairments in learning ability as well as other neurotoxic harms among rats with only mild forms of fluorosis.²³ (Liu et al. 2011; Pereira et al. 2011; Niu et al. 2008; Chioca et al. 2008). As noted by Niu et al., “these findings indicate that fluoride . . . can influence spontaneous behaviors and lower the learning ability of rats before the appearance of dental lesions.”²⁴ (Angmar-Mansson & Whitford 1982).

Taken together, the available human and animal studies suggest that fluoride can impair cognitive abilities prior to the development of severe fluorosis. This has obvious public health relevance in the United States, since recent studies show that the prevalence of dental fluorosis is now at historically unprecedented levels. In CDC’s 1999-2004 NHANES survey, for example, 41% of adolescents were diagnosed with dental fluorosis, including 8.6% with mild fluorosis, and 4% with moderate and severe. These rates are considerably higher than what was found in the 1986-87 national survey by the National Institute of Dental Research. (Beltran et al. 2010; Heller et al. 1997). Moreover, the rates appear to have increased yet further since the 1999-2004 NHANES survey. Specifically, the 2011-2012 NHANES survey found dental fluorosis in 58.3% of the surveyed adolescents, including an astonishing 21.2% with moderate fluorosis, and 2% with severe. (NHANES 2014). Since there are an estimated 42 million adolescents currently living in the U.S.,²⁵ the NHANES data suggests that up to 24 million adolescents now have some form of dental fluorosis, with over 8 million adolescents having moderate fluorosis, and 840,000 having severe fluorosis.

The NHANES surveys do not provide data on the respective rates of fluorosis in fluoridated vs. non-fluoridated communities, but research has repeatedly confirmed that both the prevalence and severity of dental fluorosis are greater in U.S. communities with fluoridated water than in communities without. (Heller et al. 1997; Jackson et al. 1995; Williams & Zwemer 1990). Ending fluoridation will thus reduce the number of children developing dental fluorosis, and the accompanying neurotoxic risks associated with the doses that produce fluorosis.²⁶

²² Some studies, however, including Ding, have not found a clear relationship between IQ and dental fluorosis status, thus suggesting that a person’s susceptibility to fluoride-induced neurotoxicity may be distinct from their susceptibility to dental fluorosis. (Asawa et al. 2014; Li et al. 2010)

²³ Consistent with this, Zhou Z. et al. (2016) recently reported that biochemical changes occur in rats at doses well below those that cause dental fluorosis.

²⁴ While rodent teeth undergo constant remodeling, thus distinguishing them from human teeth, research has found that rat teeth develop dental fluorosis at the same serum fluoride levels that produce fluorosis in humans. According to Angmar-Mansson & Whitford, “It is well known that, in fluoridated drinking water studies with rats, a water fluoride concentration of 10-25 ppm is necessary to produce minimal disturbances in enamel mineralization. Because of the high water concentrations required, the rat has been regarded as more resistant to this adverse effect of fluoride. However, when the associated plasma levels are considered, the rat and the human appear to develop enamel fluorosis at very nearly the same concentrations.” (Angmar-Mansson & Whitford 1982, at 339) Based on this finding, Angmar-Mansson & Whitford concluded that “the rat is a better model for the study of human enamel fluorosis than previously believed.” (*Id.* at 334)

²⁵ This estimate is based on the number of Americans between the ages of 10 and 19. It comes from the Office of Adolescent Health, which is part of the Department of Health & Human Services. (DHHS 2016).

²⁶ Decreases in dental fluorosis have been documented following temporary suspensions of fluoridation as short as 11 months. (Burt et al. 2000)

VI. NEUROTOXIC RISK OF LOW DOSE FLUORIDE IS FURTHER SUPPORTED BY ANIMAL AND CELL STUDIES

The studies linking fluoride exposure with neurotoxic effects in humans are consistent with research on both experimental animals and cell cultures. Studies on rodents, for example, have found neurotoxic effects, including learning impairments, at water fluoride levels less than 15 mg/L, with 8 studies published since the NRC review reporting neurotoxic effects at water fluoride levels less than 5 mg/L. These are notably low fluoride levels for rodents, since it is generally estimated that rats require approximately 5 times more fluoride in their water to achieve the same level of fluoride in their blood as humans, and over 10% of children living in fluoridated areas receive the same waterborne dosage of fluoride (mg/kg/day) as rats drinking water with up to 9 mg F/L. (NTP 2016, at 56-57)

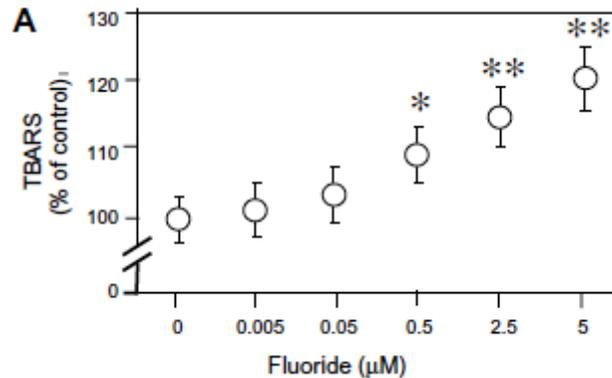
The following table lists the water fluoride concentrations associated with neurotoxic effects in rodents:

Study	F Concentration (F-)	Duration of Treatment	Effects
Chouhan (2010)	1 mg/L	4 months	Oxidative stress; alterations in neurotransmitters
Wu (2008)	1 mg/L	Gestation	Behavioral alterations
Gao (2009)	2.3 mg/L	6 months	Enzyme inhibition; impaired cognition; oxidative stress
Liu (2014)	2.3 mg/L	1 month	Impaired learning
Liu (2010)	2.3 mg/L	6 months	Impaired cognition; alterations in neurotransmitters
Sandeep (2013)	2.3 mg/L	3 months	Behavioral alterations; enzyme inhibition
Zhang (2015)	2.3 mg/L	6 months	Oxidative stress; activation of AGE/RAGE system
Zhang Z. (2008)	4.5 mg/L	10 weeks	Impaired learning; pathological changes in synaptic structure
Zhu (2011); Zhang (2011); Zhang J. (2013)	6.8 mg/L	9 months	Trend towards decreased synaptic membrane fluidity & PSD-95 expression level; altered expression of CaMKII α , c-fos, Bax, and Bcl-2 (statistically significant at 13.6 mg/L)
Bhatnagar (2011)	8 mg/L	1 month	Morphological changes in neurons
Banala (2015)	9 mg/L	Gestation + 30 days postnatal	Impaired learning; loss of motor control; & oxidative stress
Reddy (2014)	9 mg/L	3 months	Alterations in neurotransmitters; altered immunological parameters; oxidative stress
Lou (2014); Lou (2013)	10 mg/L	6 months	Increase in apoptotic neurons; altered expression of Bax and Bcl-2 at protein & mRNA levels; abnormal mitochondrial dynamics
Sun (2008)	10 mg/L	6 months	Impaired learning; increased ChE
Han (2014)	11 mg/L	6 months	Trend towards impaired learning (Fig 2a)
Zhou (2014)	11.3 mg/L	6 months	Altered expression levels of cytokines in hippocampus
Guner (2016)	13.6 mg/L	Gestation + Postnatal	Increased catalase immunoreactivity

Fluoride's ability to cause neurotoxic effects at low levels of exposure is further corroborated by in vitro cell studies conducted subsequent to the NRC review. While most of the in vitro studies

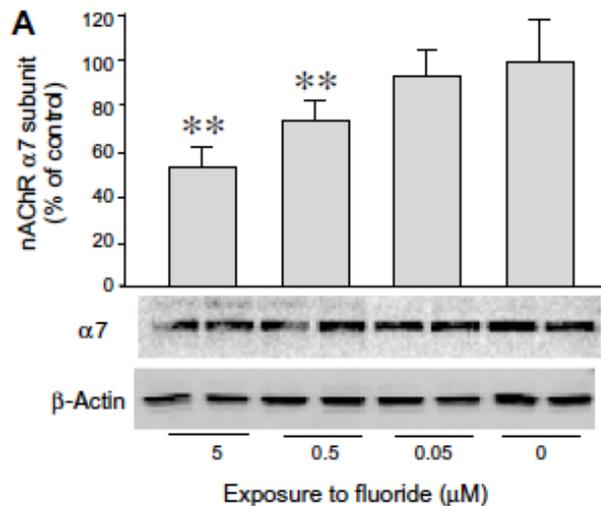
used high levels of fluoride (≥ 10 mg/L), two of the studies investigated the effects of concentrations that are found in the bloodstream of many Americans.²⁷ Both of these low-concentration studies detected adverse effects. As displayed in the following figure, Gao et al. (2008) found that just 0.5 μM of fluoride (i.e., 0.009 mg/L) caused lipid peroxidation in SH-SY5Y cells after 48 hours of exposure. Most individuals living in fluoridated areas in the United States have fluoride levels in their blood that exceed this level. (CDC 2014; Kissa 1987).

FIGURE 6: Level of Lipid Oxidation in SH-SY5Y Cells Exposed to Fluoride
(SOURCE: Gao et al. 2008, Fig. 1)



The Gao study also found that 0.5 μM had an effect on the level of $\alpha 7$ nAChR protein in the SH-SY5Y cells, as displayed in the following figure:

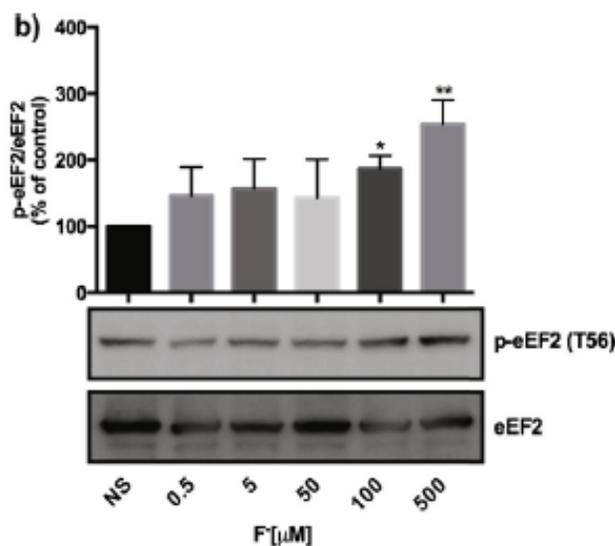
FIGURE 7: Level of $\alpha 7$ nAChR subunit protein in SH-SY5Y Cells Exposed to Fluoride
(SOURCE: Gao et al. 2008 Fig. 3)



²⁷ Consistent with the findings of these two brain cell studies, the in vitro studies by Gutowska have repeatedly found that concentrations of just 1 to 3 μM (i.e., 0.019 to 0.057 mg/L) are sufficient to affect inflammatory responses. (Gutowska et al. 2015, 2012, 2010). The Gutowska team's findings underscore the biologically active nature of even micromolar concentrations of fluoride, and warrant consideration for their implications to neuroinflammation. (Louveau et al. 2011).

Flores-Mendez et al. (2014) also investigated the effect of 0.5 μM , and, per the following figure, found a suggestive trend towards an increase in eEF2 phosphorylation in cultured Bergmann glia cells (BGC) after 15 minutes of treatment.

FIGURE 8: eEF2 Phosphorylation in BGC Cultures Treated with Fluoride
(SOURCE: Flores-Mendez et al. 2014., Fig. 4b)



Flores-Mendez also found a suggestive trend towards an increased influx of calcium into the cell after 3 minutes of treatment with 5 μM fluoride (i.e., 0.095 mg/L). (Flores-Mendez et al. 2014, at 130 Fig. 5c) This concentration can be found chronically in the blood of children with kidney disease living in fluoridated areas, (Warady et al. 1989), and is intermittently exceeded by children ingesting fluoride supplements, fluoridated toothpaste, and other dental products.²⁸

VII. RECENT EPIDEMIOLOGICAL STUDIES CORROBORATE NEUROTOXIC RISK FROM FLUORIDATED WATER IN WESTERN POPULATIONS

The overlap between the internal doses of fluoride experienced in western populations and the internal doses associated with neurotoxic effects in humans, animals, and cell cultures, is cause for public health concern. Although there has been a notable lack of epidemiological research into fluoride's neurotoxic effects in the U.S., a 2015 study by Malin and Till found a statistically significant correlation between the prevalence of water fluoridation at the state level and Attention-Deficit Hyperactivity Disorder (ADHD). Fluoridation prevalence significantly correlated with ADHD even after controlling for socioeconomic status (SES), and fluoridation "appeared to be the more robust predictor." As Malin and Till note, their findings "are consistent with prior epidemiological studies that have associated high and low fluoride concentration exposure with neurodevelopmental effects in children."

²⁸ While there is a paucity of research on the serum fluoride levels following use of fluoride tablets and toothpaste, Ekstrand found that, among a group of 5 preschool children, ingestion of 0.5 mg fluoride tablets caused serum fluoride levels to spike to 0.095 mg/L in 30 minutes, while ingestion of 0.6 mg fluoride in toothpaste caused serum fluoride levels to exceed 0.08 mg/L. (Ekstrand et al. 1983, Fig. 1). Since some preschool children swallow considerably more than 0.6 mg fluoride per brushing, the serum fluoride levels will likely be higher than 0.08 mg/L in those children. Levy & Guha-Chowdhury, for example, cite research showing that 10% of preschool children swallow in excess of 0.73 mg of fluoride per brushing. (Levy & Guha-Chowdhury 1999, Tbl. 3).

Another epidemiological study from 2015, by Peckham et al., provides further corroborative evidence that fluoridation can cause neurotoxic effects. Peckham's study examined the relationship between water fluoride levels and hypothyroidism in the United Kingdom, and found that fluoride levels ≥ 0.7 mg/L significantly correlated with higher rates of hypothyroidism. This correlation was strengthened, not weakened, when controlling for the covariates of age, gender, and index of deprivation.

The correlation between fluoridation and hypothyroidism reported by Peckham is (i) plausible and (ii) adds further support for the capacity of fluoridated water to cause neurotoxic effects. First, the correlation is plausible because, as summarized by the NRC, multiple lines of research indicate that fluoride can lower thyroid function, including the fact that fluoride was once used as a drug for this precise purpose, at doses as low as 2 to 5 mg/day. (NRC 2006; Galletti & Joyet 1958). Second, the correlation between fluoridation and hypothyroidism adds further support for fluoridation's neurotoxic potential because, as recognized in EPA's *Guidelines*, "the development of the nervous system is intimately associated with the presence of circulating hormones such as thyroid hormone." (EPA 1998, at 50). Since both clinical and subclinical hypothyroidism during pregnancy have been associated with reduced IQ in offspring, (Korevaar et al. 2016; Murphy et al. 2015; Klein et al. 2001), the relationship between fluoridation and hypothyroidism provides a mechanism by which fluoridation can reduce IQ, even absent a direct neurotoxic effect.

VIII. SUSCEPTIBLE SUBPOPULATIONS ARE AT HEIGHTENED RISK OF FLUORIDE NEUROTOXICITY AND NEED PROTECTION

EPA's *Guidelines* recognize that individual susceptibility to the neurotoxicity of environmental toxicants can vary by a factor of ten or more,²⁹ and is influenced by factors such as nutritional status, age, genetics, and disease. (EPA 1998, at 63-65, 78). Each of these factors—nutritional status, age, genetics,³⁰ and disease—are known to influence an individual's susceptibility to chronic fluoride toxicity.³¹ Any factor that can predispose an individual to chronic fluoride toxicity should be suspected as a factor that will predispose to fluoride neurotoxicity as well. In fact, recent research in both humans and animals has specifically demonstrated that nutrient deficiencies (i.e., iodine³² and calcium³³) amplify fluoride's neurotoxicity.³⁴ Further, Zhang S. et al. (2015) reported that certain COMT gene polymorphism

²⁹ "In general, it is assumed that an uncertainty factor of 10 for intrapopulation variability will be able to accommodate differences in sensitivity among various subpopulations, including children and the elderly. However, in cases where it can be demonstrated that a factor of 10 does not afford adequate protection, another uncertainty factor may be considered in conducting the risk assessment." (EPA 1998, at 65)

³⁰ Studies have repeatedly confirmed that genetic factors can significantly increase susceptibility to fluoride toxicity, (Everett 2011), including effects on bone (Kobayashi et al. 2014; Yan et al. 2007; Mousny et al. 2006); teeth (Buzalaf et al. 2014; Ba et al. 2011; Huang et al. 2008; Everett et al. 2002); and reproductive hormones (Zhou et al. 2016).

³¹ See, e.g., Irigoyen-Camacho ME et al. (2016); Simon et al. (2014); Ravula et al. (2012); Itai et al. (2010); Schiffli (2008); NRC (2006); Teotia et al. (1998); Torra et al. (1998); Warady et al. (1989); and Turner et al. (1995). For additional citations and discussion, see http://www.fluoridealert.org/studies/skeletal_fluorosis03.

³² See, e.g., Ge et al. (2011); Hong et al. (2008); Ge et al. (2005); Wang et al. (2004); Xu et al. (1994); Lin et al. (1991); Ren et al. (1989); Guan et al. (1988).

³³ Sun et al. (2016); Ekambaram & Paul (2002).

³⁴ As discussed earlier, the study by Das & Mondal (2016) examined the impact of fluoride on IQ in a population with a high prevalence of underweight children, suggestive of an area with chronic malnutrition. In this population, a daily fluoride dose of just 0.06 mg/kg/day was associated with a sharp 15-point drop in IQ among children with mild fluorosis. (Das & Mondal 2016, at 218, Tbl. 3).

greatly influences the extent of IQ loss resulting from fluoride exposure, which is consistent with research on other neurotoxins, including methyl mercury. (Julvez & Grandjean 2013).

While the full range of individual susceptibility to fluoride neurotoxicity in the U.S. cannot be precisely calculated, some subpopulations can be identified as being at elevated risk, including infants,³⁵ the elderly,³⁶ and individuals with (A) deficient nutrient intake (particularly iodine and calcium),³⁷ (B) certain COMT gene polymorphisms,³⁸ and (C) kidney disease.³⁹ Various factors suggest that African Americans may also suffer disproportionate risks as well, including elevated use of infant formula,⁴⁰ elevated exposure to lead,⁴¹ depressed calcium and anti-oxidant intake,⁴² and significantly higher rates of dental fluorosis, including in its moderate and severe forms.⁴³

³⁵ Although *breast fed* infants receive the lowest fluoride intake by bodyweight (<0.001 mg/kg/day) of all age-groups (Ekstrand et al. 1981), this situation is flipped on its head when infants are fed *formula reconstituted with fluoridated water*. As noted by the NRC, “On a per-body-weight basis, infants and young children have approximately three to four times greater exposure than do adults.” (NRC 2006, at 3). Not only do formula-fed infants receive an unnaturally high dose, they have an impaired ability to excrete the fluoride they ingest, retaining up to 87% of the absorbed dose. Ekstrand et al. (1994). Infants exposed to formula made with fluoridated water are at significantly higher risk for developing dental fluorosis on their permanent front teeth. Hong et al. (2006). In light of the research linking dental fluorosis and modest levels of fluoride exposure with reduced IQ, infants are a susceptible subpopulation of critical concern for fluoride neurotoxicity.

³⁶ As noted in the *Guidelines*, “[T]he aged population is considered to be at particular risk [of neurotoxicity] because of the limited ability of the nervous system to regenerate or compensate to neurotoxic insult.” (EPA 1998, at 65). This is of concern because the brain will be more exposed to fluoride in older age due to the (1) increased level of fluoride circulating in the serum from both age-related decreases in renal function and age-related increases in bone resorption (particularly in post-menopausal women), and (2) increased permeability of the blood-brain barrier. Rosenberg (2014); Ravula et al. (2012); Itai et al. (2010); Torra et al. (1998). This may help explain the very high prevalence of cognitive impairment (82%) found among elderly individuals in an endemic fluorosis area. Li et al. (2016); see also Shao et al. (2003).

³⁷ According to a consensus paper in the *Journal of the National Medical Association*, “Eighty-six percent of African Americans get just more than half of the daily recommended amount of calcium, and only half consume one or more servings of dairy a day. Of particular concern, 83% of African-American children 2-17 years of age are not getting enough calcium.” Wooten & Price (2004). Insufficient nutrient intakes in the United States are severe enough in some individuals to qualify as nutrient deficiencies. Recent NHANES data, for example, found that 6% of Americans have a vitamin C deficiency. CDC (2012). Vitamin C deficiency has been found to exacerbate fluoride’s toxicity in humans, while vitamin C supplementation has been found to ameliorate fluoride’s neurotoxic effects in animals. Nabavi et al. (2013); Basha & Madhusudhan (2010); Pandit et al. (1940). With respect to iodine, NHANES data shows that women of *child bearing* age (20 to 39 years old) have “median urine iodine concentrations bordering on insufficiency.” Pfeiffer et al. (2013). Children born to women with insufficient iodine levels should be considered a susceptible subpopulation for fluoride neurotoxicity due to fluoride’s ability to exacerbate the neurological effects of inadequate iodine.

³⁸ The study by Zhang S. et al. (2015) suggests that children with the COMT val/val genotype suffered a five-fold larger drop in IQ than children with the COMT val/met and met/met genotypes. As noted by Zhang, “In the subpopulation carrying the COMT reference genotype (Model 3), 1 unit increase in urinary fluoride (1 mg/l) was associated with a decrease of 9.67 points of IQ and was significant after controlling for covariates (P=0.003). Among children carrying variant genotypes, 1 unit increase in [urinary fluoride] resulted in a decrease of 1.85 IQ points, but this was not statistically significant in this stratum.”

³⁹ See, e.g., Schiffli (2008); Ibarra-Santana et al. (2007); Torra et al. (1998); Warady et al. (1989).

⁴⁰ In national surveys conducted between 2000 and 2008, “Black infants consistently had the lowest rates of breastfeeding initiation and duration across all study years.” CDC (2013b).

⁴¹ It is well established that non-Hispanic black children have higher levels of lead in their blood than non-Hispanic white children. CDC (2013a); Bernard & McGheein (2003). This has relevance to the risks of fluoride exposure, since animal studies have found that fluoride can exacerbate the toxicity of lead, and vice versa. Leite et al. (2011); Sawan et al. (2010); Mahaffey & Stone (1976).

⁴² Watters et al. (2007); Wooten & Price (2004). The reduced level of anti-oxidants found in the blood of African American adults, which may relate to low consumption of fresh fruits and vegetables (Zenk et al. 2005), has implications for fluoride toxicity, because oxidative stress is a key mechanism by which fluoride harms cells, (Barbier 2010), including in the brain. (E.g., Banala & Karnati 2015; Zhang K. et al. 2015; Basha et al. 2014; Nabavi et al.

Any risk assessment on the neurotoxicity of fluoride must thus be mindful of the need to protect susceptible subpopulations; anything less would be inconsistent with EPA’s *Guidelines*. In fact, even where there is *no* specific information to indicate differential susceptibility to a neurotoxin, EPA’s *Guidelines* state that a margin of safety (i.e., “uncertainty factor”) should still be incorporated to account for “*potential* differences in susceptibility.” (EPA 1998, at 78). In the case of fluoride, there is *uncontroverted* evidence indicating substantial differences in susceptibility, and thus the basis for applying an uncertainty factor is especially strong.

IX. A REFERENCE DOSE PROTECTIVE AGAINST FLUORIDE NEUROTOXICITY IS INCOMPATIBLE WITH WATER FLUORIDATION IF STANDARD RISK ASSESSMENT PROCEDURES ARE APPLIED

As recognized in EPA’s *Guidelines*, it is standard risk assessment practice to apply “uncertainty factors” (UF) of 10 when converting a LOAEL, NOAEL, or BMD into a safe “reference dose” (RfD) or “reference concentration” (RfC). (Martin et al. 2013) This is significant because application of even a single UF of 10 to the daily doses/concentrations of fluoride associated with neurotoxic harm in humans and animals produces an RfD or RfC that is less than, and thereby *incompatible with*, the levels of fluoride added to water for fluoridation (0.7 to 1.2 mg/L). This point is illustrated in the following table, which shows what the RfD and RfC would be if *merely* one UF of 10 was applied to the various fluoride exposures that have been associated with neurotoxic harm.

Fluoride Dose/Concentration Producing Harm	Study	Effect	RfD/RfC After Application of one UF	Water Fluoridation Doses/Concentrations
0.06 mg/kg/day (Dose/Humans)	Das (2016)	Reduced IQ	0.006 mg/kg/day	0.03 to 0.09 mg/kg/day (Average Total Daily Dose in F areas) (NRC 2006, Tbl 2-13)
0.08 mg/kg/day (Dose/Humans)	Wang (2012)	Reduced IQ	0.008 mg/kg/day	0.03 to 0.09 mg/kg/day (Average Total Daily Dose in F areas) (NRC 2006, Tbl 2-13)
1 mg/L (Water/Rats)	Chouhan (2010); Wu (2008)	Behavioral alterations; Neurochemical changes	0.1 mg/L	0.7 to 1.2 mg/L (Water F Levels in F areas)
0.7 to 1.2 mg/L (Water/Humans)	Malin (2015); Peckham (2015)	Hypothyroidism; ADHD	0.07 to 0.12 mg/L	0.7 to 1.2 mg/L (Water F Levels in F areas)
0.7 to 1.2 mg/L (Water/Humans)	Sudhir (2009)	Reduced IQ	0.07 to 0.12 mg/L	0.7 to 1.2 mg/L (Water F Levels in F areas)

2013; Nabavi et al. 2012a,b,c; Basha et al. 2011; Inkielewicz-Stepniak & Czarnowski 2011; Nabavi et al. 2011; Bharti & Srivastava 2009; Gao et al. 2009).

⁴³ Studies dating back to the 1960s have found that African Americans suffer higher rates of dental fluorosis than Caucasians. Martinez-Mier & Soto-Rojas 2010; Beltran-Aguilar et al. (2015, tbl. 23); Kumar (2000); Williams & Zerner (1990); Butler et al. (1985); Russell (1962). Consistent with this, documents obtained through the Freedom of Information Act show a stark racial disparity in adolescent fluorosis rates in CDC’s 1999-2004 NHANES survey, with 58% of African American adolescents diagnosed as having the condition, versus 36% of white adolescents. FOIA (2011).

2.3 mg/L (Water/Rats)	Gao (2009); Liu (2014); Liu (2010); Sandeep (2013); Zhang K (2015)	Impaired learning; Behavioral alterations; Neurochemical changes	0.23 mg/L	0.7 to 1.2 mg/L (Water F Levels in F areas)
2.3 mg/L (Water/Humans)	The average water F concentration in the 13 studies reviewed by Choi (2012) which found effects at < 4 mg/L	Reduced IQ	0.23 mg/L	0.7 to 1.2 mg/L (Water F Levels in F areas)
0.05 mg/L (Serum/Humans)	Xiang (2011)	Reduced IQ	0.005 mg/L	0.019 to 0.076 mg/L (Typical range of Serum F in US) (CDC 2014)

The need to apply *at least* one UF to the doses/concentrations associated with fluoride neurotoxicity cannot seriously be disputed. After all, these are doses and concentrations associated with overt neurotoxic harm, and thus the safe reference dose will obviously need to be set at a lower level. Moreover, as discussed above, EPA's *Guidelines* recognize that there is often a large degree of intra-species variability in the way humans respond to neurotoxins and a default factor of 10 is generally considered necessary to protect against this variability.⁴⁴

Although we have only utilized one uncertainty factor in the analysis here, we do *not* mean to imply that only one UF is sufficient for converting these adverse effect levels into RfDs or RfCs. Indeed, it is clearly insufficient to apply only one UF when converting a LOAEL from an animal study into a safe dose for humans. We present the above Table, therefore, for the limited purpose of demonstrating that *even if* EPA were to apply an *insufficiently* protective UF, the resulting RfD or RfC would still be incompatible with water fluoridation; thus highlighting, once again, the overlap between the doses associated with a neurotoxic risk and the doses many Americans now receive.

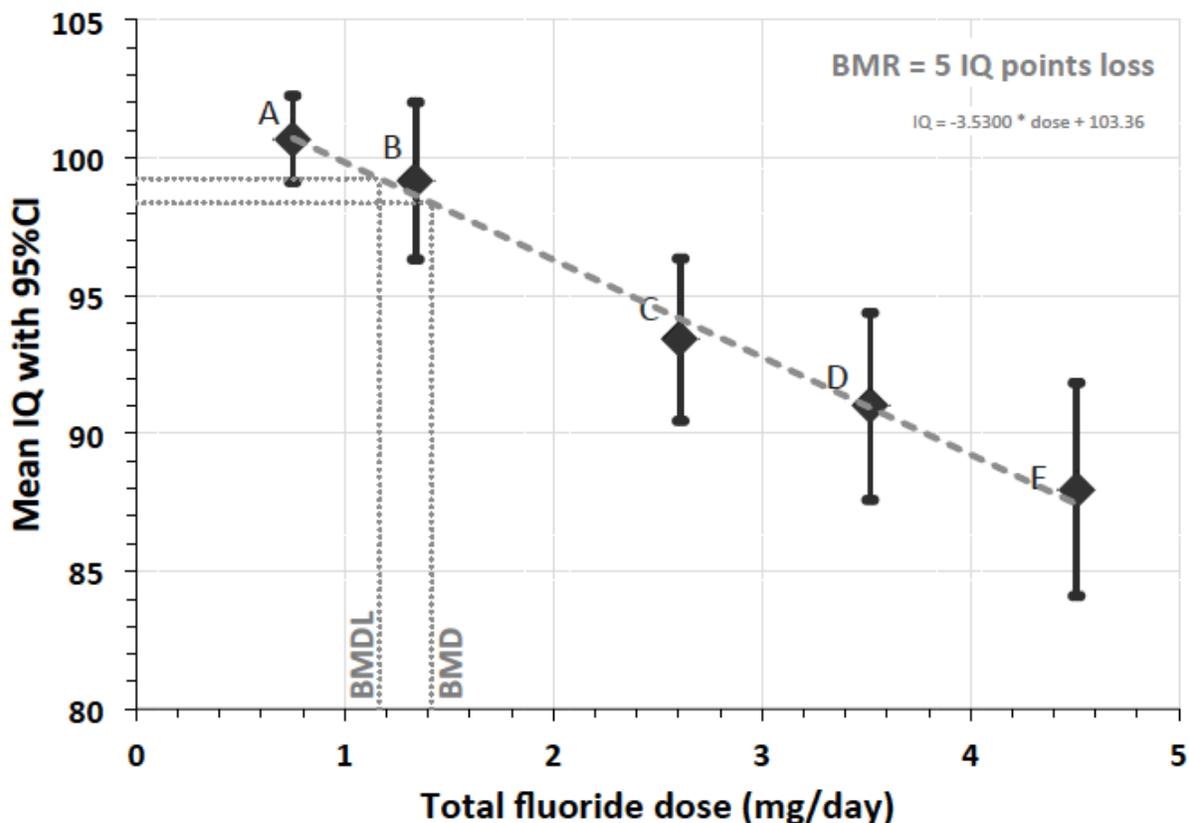
Finally, Petitioners recognize that EPA has a preference for utilizing Benchmark Dose (BMD) methodology for risk assessments where there is dose-response data that permits the analysis. In the case of fluoride neurotoxicity, the Xiang dataset is a suitable dataset for conducting a BMD analysis, as it shows a dose-related reduction in IQ spanning five dose groups ranging from 0.75 to 4.5 mg F/day without an apparent NOAEL. (Wang et al. 2012). EPA's *Guidelines* recognize the probative value (and rarity) of a human dataset covering more than three dose groups.⁴⁵ Further, the Xiang dataset benefits from the fact that the study controlled for most of the key confounding factors, including lead, arsenic, iodine, parental education, and socioeconomic status. (Xiang et al. 2003a,b; Xiang et al. 2013).

⁴⁴ According to the *Guidelines*, "In general, it is assumed that an uncertainty factor of 10 for intrapopulation variability will be able to accommodate differences in sensitivity among various subpopulations, including children and the elderly. However, in cases where it can be demonstrated that a factor of 10 does not afford adequate protection, another uncertainty factor may be considered in conducting the risk assessment." (EPA 1998, at 65). As demonstrated by Martin et al. (2013), the use of a default uncertainty factor of 10 to account for intra-species variability is amply justified by empirical data on differences in human sensitivity related to genetic polymorphisms, gender, disease, old age, and toxicokinetics.

⁴⁵ The *Guidelines* note that (1) "Human studies covering a range of exposures are rarely available" and (2) "Evidence for a dose-response relationship is an important criterion in establishing a neurotoxic effect, although this analysis may be limited when based on standard studies using three dose groups or fewer." (EPA 1998, at 50 & 106).

As with the LOAEL analyses discussed above, application of the BMD methodology to the Xiang dataset produces an RfD for fluoride that is incompatible with water fluoridation. Specifically, applying EPA’s BMDS software to Xiang’s dataset produces a BMD of just **1.4 mg F/day**, if the BenchMark Response (BMR) is set at 5 IQ points, as displayed in the following figure.⁴⁶ This result can be interpreted as predicting that children exposed to 1.4 mg fluoride per day will have, on average, 5 less IQ points than children exposed to no fluoride. The RfD would obviously need to be set at a lower level, since such a large loss in IQ is clearly an adverse effect, and because uncertainty factors would need to be added to account for variation in sensitivity within a population as large as the U.S.

FIGURE 9: BMD for Loss of 5 IQ Points from Fluoride
(Linear Model, BMR = 5 IQ Points)



X. THE BROADBENT STUDY DOES NOT ESTABLISH THE SAFETY OF FLUORIDATION

Some commentators have incorrectly claimed that the recent study by Broadbent et al. establishes the safety of water fluoridation for neurologic development. The Broadbent study found no difference in the IQs of children and adults who spent their first 3 to 5 years of life in fluoridated (0.7 to 1.0 mg/L) vs. non-fluoridated (0 to 0.3 mg/L) areas of Dunedin, New Zealand. A glaring limitation with the Broadbent study, however, is that a substantial portion of the “non-fluoridated” control population used 0.5 mg/day fluoride tablets and fluoridated toothpaste, resulting in only a marginal difference in average total fluoride exposure between the fluoridated

⁴⁶ If the BMR is set at 1 IQ point, the BMD is 0.28 mg/day of fluoride.

and non-fluoridated populations.⁴⁷ In fact, in response to criticism on this point, (Osmunson et al. 2016), the authors conceded that the average difference in total daily intake between the children in the fluoridated and non-fluoridated areas would be ≤ 0.3 milligrams per day, while the average intake for all subjects was 0.9 mg/day.⁴⁸ (Broadbent et al. 2016). At most, therefore, the Broadbent study established that ≤ 0.3 milligrams of fluoride was not a sufficiently large enough contrast in daily fluoride exposure to produce a demonstrable effect on *average IQ* in the study cohort. This does *not* mean, however, that the fluoride exposures in a fluoridated community are safe, since no truly low exposure comparison group existed in the Broadbent study, and the Broadbent team made no attempt to study vulnerable subsets of the population (e.g., those with suboptimal nutrition, genetic polymorphisms, etc).

The inherent limitation resulting from the Broadbent study's comparison of populations with marginal contrasts in fluoride intake highlights an important strength of the endemic fluorosis/IQ studies from China, India, Iran, and Mexico. Specifically, the endemic fluorosis studies have generally compared communities with clear and stable contrasts in fluoride exposure, thus increasing the power of these studies to detect fluoride's effect on IQ. Moreover, unlike Broadbent's study, many of the endemic fluorosis studies have analyzed the relationship between IQ and individual measures of exposure (e.g., individual urine fluoride levels), thus overcoming the limitation imposed by Broadbent's ecological (group level) estimates of fluoride intake. Although Broadbent and others have criticized the endemic fluorosis studies for failing to control for potential confounders, several of these studies did carefully control for confounders and the association between fluoride and cognitive impairment remained intact. (Choi et al. 2015; Rocha Amador et al. 2009; Xiang et al. 2003a,b; Xiang et al. 2013). Further, while it's undisputed that many of the IQ studies used relatively simple study designs, the consistency of these studies, and their repeated corroboration by research showing that fluoride impairs learning in rodents under carefully controlled laboratory conditions, gives confidence to the conclusion that fluoride is a neurotoxin that impairs cognition.

For the foregoing reasons, the reference dose for protecting against fluoride neurotoxicity cannot reasonably be based on a risk assessment that treats the Broadbent study as establishing 0.7 to 1.0 mg/L as a NOAEL without application of an uncertainty factor(s) to account for intra-human variability and other issues left unanswered by Broadbent's study. Indeed, as spelled out in the *Guidelines*, it is problematic to develop an NOAEL based on a single study of a single neurotoxic endpoint,⁴⁹ particularly a study with such limited "dose spacing" between the groups.⁵⁰

⁴⁷ There are several other significant problems with the Broadbent study as well. First, the study did not collect any data on individual water intake or internal biomarkers of fluoride exposure (e.g., urine fluoride, etc). Second, the study used a crude estimate of fluoride toothpaste usage ("always" vs "sometimes" vs "never") that fails to account for the frequency of brushings per day and actual amount of toothpaste used per brushing, thus obscuring the very large variations of daily exposure that occur among children using fluoride toothpaste. Zohoori et al. 2012; Levy & Guha-Chowdhury 1999, tbl 3. Third, it did not control for potential confounders including blood lead and maternal IQ, even though such information was available and there are plausible reasons for the non-fluoridated subjects to have elevated lead exposure from living in a more rural area known for its highly corrosive drinking water. (Osmunson et al. 2016).

⁴⁸ A previous study of total fluoride intake among 3-to-4 year olds in fluoridated and non-fluoridated areas of New Zealand found the daily intakes to be 0.68 ± 0.27 and 0.49 ± 0.25 mg F/day, respectively. (Guha-Chowdhury et al. 1996).

⁴⁹ According to the *Guidelines*, "Neurotoxic effects (and most kinds of toxicity) can be observed at many different levels, so only a single endpoint needs to be found to demonstrate a hazard, but many endpoints need to be examined to demonstrate no effect. For example, to judge that a hazard for neurotoxicity could exist for a given agent, the minimum evidence sufficient would be data on a single adverse endpoint from a well-conducted study. In

XI. THE BENEFITS OF PREVENTING FLUORIDE NEUROTOXICITY DWARF THE COSTS OF RESTRICTING FLUORIDE CHEMICALS

EPA's authority to act under Section 6 of TSCA is premised on two distinct findings: (1) a *risk* exists and (2) the risk is *unreasonable*. Here, in evaluating the preliminary question of whether a neurotoxic risk exists from use of fluoridation chemicals, the EPA is duty bound to follow its *Guidelines*, as the Agency has stated it “will follow” the *Guidelines* when “evaluating data on *potential* neurotoxicity associated with exposure to environmental toxicants.” (EPA 1998, at 3). For the reasons set forth above, a good faith application of these *Guidelines* to the current research on fluoride will show that neurotoxicity is a hazard of fluoride exposure, and that the doses associated with this hazard overlap the doses—as reflected by (a) total daily intake, (b) urinary fluoride level, (c) serum fluoride level, and (d) severity of dental fluorosis—that U.S. children are exposed to in areas with fluoridated water. Neurotoxicity must thus be considered a risk from adding fluoridation chemicals to drinking water.

Petitioners now turn, therefore, to the second prong of the inquiry: whether the neurotoxic risk posed by fluoridation chemicals is an unreasonable one. As EPA has stated, the reasonableness inquiry considers the benefits of reducing the risk with the costs of doing so. EPA (1985); 15 U.S.C. § 2605(c)(A). In considering these respective benefits and costs of risk reduction, EPA has stated it will take into account “the extent and magnitude of risk posed; the societal consequences of removing or restricting use of products; availability and potential hazards of substitutes, and impacts on industry, employment, and international trade.” EPA (1985); see also 15 U.S.C. § 2605(c)(A). We turn now to a consideration of these factors

A. Extent and Magnitude of Neurotoxic Risk from Fluoridation Chemicals

There is little question that neurotoxicity is a serious insult to health. (Grandjean & Landrigan 2014). In a nation besieged by neurological disorders of poorly understood etiology, both in young children and the elderly, minimizing exposures to known neurotoxic substances should be a public health priority. (*Id.*)

The reduction in IQ associated with fluoride exposure has been found to be severe enough in some children to produce mental retardation. (*E.g.*, Lin et al. 1991). But even the loss of a single IQ point is associated with significant economic loss. As calculated by Spadaro et al. (2008), a loss of a single IQ point causes an average drop in lifetime earnings of \$18,000 in 2005 U.S. dollars, which, when adjusted for inflation, amounts to \$22,250 in current dollars.⁵¹ Since 200 million Americans now live in areas where water is fluoridated,⁵² and since virtually all Americans consume processed foods and beverages made with fluoridated water, any reduction in IQ from consumption of fluoride-treated water stands to have very large economic consequences.

contrast, to judge that an agent is unlikely to pose a hazard for neurotoxicity, the minimum evidence would include data from a host of endpoints that revealed no neurotoxic effects.” (EPA 1998, at 55).

⁵⁰ According to the *Guidelines*, “the NOAEL is also directly dependent on the dose spacing used in the study.” (EPA 1998, at 57)

⁵¹ We adjusted for inflation by using the U.S. Bureau of Labor Statistics' CPI Inflation Calculator at <http://data.bls.gov/cgi-bin/cpicalc.pl>.

⁵² The CDC states that 211,393,167 Americans now drink fluoridated water; the vast majority of this population is consuming artificially fluoridated water, as CDC estimates that only 11,883,007 Americans have “naturally” fluoridated water. See: <http://www.cdc.gov/fluoridation/statistics/2014stats.htm>

While the precise extent to which fluoridation is reducing IQ in the U.S. cannot yet be calculated, the dose-response data from Wang et al. (2012) indicates that daily consumption of a liter of fluoridated water per day (=0.7 mg F/day) during childhood would cause IQ to drop by an average of 2.5 points when compared to children with no exposure to fluoride, while consumption of half a liter per day (=0.35 mg F/day) would cause IQ to drop by an average of 1.25 IQ points. (Wang's data is consistent with a linear, no threshold, dose-response relationship between fluoride and IQ, and we have applied Wang's data here with that assumption.)

In 2010, there were 74.2 million children under the age of 18 living in the U.S., of which we can estimate roughly 50 million were living in fluoridated areas.⁵³ US Census Bureau (2011). If we apply Wang's dose-response data and assume that these 50 million children consumed between 0.5 to 1 liters of fluoridated water per day during childhood, fluoridation would have caused a loss of between 62.5 to 125 million IQ points. Based on the earnings data from Spadaro et al. (2008), a loss in the range of 62.5 to 125 million IQ points represents a total loss in lifetime earnings of between \$13.9 to 27.8 *trillion* for this generation.

Due to the sheer number of people exposed to fluoridation chemicals, even if only sentinel or susceptible populations in fluoridated areas suffer IQ loss, the economic impacts will still be substantial. For example, even if we conservatively assume that only 1 to 5% of children in a fluoridated area suffer any IQ loss,⁵⁴ and even if this IQ loss averaged just 1 IQ point,⁵⁵ this would still amount to 500,000 to 2,500,000 lost IQ points, with a total loss in lifetime earnings ranging from \$11.1 billion to \$55.6 billion for this generation alone.

In short, because of the *massive* extent of exposure to fluoridation chemicals in the U.S., even small effects on IQ will have very substantial economic consequences.

B. Societal Consequences of Restricting Use of Fluoridation Chemicals

If EPA exercised its authority under TSCA to ban the waterborne use of fluoridation chemicals, the one and only potential societal consequence would be an increase in tooth decay. Current research, however, indicates that any increase in dental treatment costs would be small, inconsistent, and far less than the loss in earnings associated with even small drops in IQ.

First, Petitioners wish to call the Agency's attention to the fact that there are no randomized controlled trials on the effectiveness of fluoridation, and few of the available studies adequately account for potential confounders like socioeconomic status, sealants, and dietary habits. (Iheozor-Ejiofor et al. 2015; Cheng et al. 2007). The evidence has thus been characterized by the Cochrane Collaboration as having "high risk of bias" and limited applicability to modern lifestyles. (Iheozor-Ejiofor et al. 2015).

⁵³ According to the CDC, 66% of the U.S. population receives fluoridated tap water. See: <http://www.cdc.gov/fluoridation/statistics/fsgrowth.htm>.

⁵⁴ We base the 1 to 5% estimate on the approximate percentage of children with serum fluoride levels in the range (~0.05 mg/L) associated with a 4-point IQ drop (n = ~1%), and the approximate percentage of children with urinary fluoride levels (\geq 1.3 mg/L) associated with clear reductions in IQ (n = 5%). For discussion of this data, see pages 9 to 12 above. Since the serum and urinary fluoride data is for the *general population*, these estimates likely *understate* the percentage of children in *fluoridated* areas with serum and urinary fluoride levels in this range.

⁵⁵ This is a substantially lower loss in IQ than would be predicted by existing research. As noted in footnote 54 above, the serum fluoride level (~0.05 mg/L) upon which this estimate is based was associated with a 4-point drop in IQ by Xiang et al. (2011). Further, research on susceptible populations has found dramatic losses in IQ from fluoride exposure, including an average 15-point drop among malnourished children with mild fluorosis. Das & Mondal (2016).

Second, methodological limitations notwithstanding, modern studies of fluoridation and tooth decay have found that the difference in cavity rates between fluoridated and non-fluoridated areas is small, inconsistent, and often non-existent, particularly in the permanent teeth. (Chankanka et al. 2011a,b; Maupome et al. 2007; Warren et al. 2006; Shiboski et al. 2003; Colquhoun 1997; Heller et al. 1997; Diesendorf et al. 1997; Leroux et al. 1996; Brunelle & Carlos 1990; Yiamouyiannis 1990; Hildebolt et al. 1989).

Because of the small and inconsistent differences in cavities now seen between fluoridated and non-fluoridated areas, sensitive measurements of tooth decay must be utilized in order to detect *any* differences in decay.⁵⁶ But, even when sensitive measurements are utilized, the differences remain small in absolute terms, inconsistent, and overshadowed by the influence of other factors known to affect decay. (Chankanka et al. 2011a; Warren et al. 2006; Armfield & Spencer 2004). A large-scale study in Australia, for example, found that adolescents who consumed fluoridated water their entire life had just 0.08 less decayed tooth surfaces (1.35 vs. 1.43 DMFS) than adolescents who consumed non-fluoridated water their entire life. (Armfield & Spencer 2004, at 290 tbl.3). Consistent with these findings, studies from Canada, Cuba, Finland, Germany, and the United States did not detect *any* measurable increase in decay following the termination of water fluoridation programs.⁵⁷ (Maupome et al. 2001; Burt et al. 2000; Kunzel et al. 2000a,b; Seppa et al. 2000).

Third, one of the few *empirical* investigations of *actual* dental costs in fluoridated vs. non-fluoridated areas found little meaningful difference in frequency or costs of treatment. (Maupome et al. 2007). The study examined the frequency and costs (in 1995 U.S. dollars) of restorative dental procedures over a six-year time period in fluoridated and non-fluoridated areas of Oregon and Washington. Consistent with other recent research, the authors noted that the difference in frequency and costs of dental treatment was “generally small,” with several of the age groups in the fluoridated areas having a higher frequency of dental treatment procedures than their peers in the non-fluoridated areas. (Maupome et al. 2007, at 228, tbl. 3). In total, the dental treatment costs in the fluoridated areas over the six-year period averaged \$355 versus \$387 in the non-fluoridated areas.⁵⁸ (*Id.* at 228, tbl. 4). When adjusted to 2016 dollars, the average difference in dental costs was thus only \$51 over the 6-year period, *or just over \$8 per person per year*. With an average life expectancy of 78.8 years,⁵⁹ the Maupome study suggests that fluoridation saves an average of \$665 in lifetime dental costs in the U.S. This amounts to less than 3 percent of the reduction in lifetime earnings that results from the loss of a single IQ point (\$22,250).

Finally, the cost-effectiveness study (Griffin et al. 2001) that advocates of fluoridation generally rely upon, is based on theoretical estimates that have several major, demonstrable problems that inflate the purported savings. (Ko & Thiessen 2015). The Griffin paper provides estimates of the annual savings in dental costs from fluoridation (in 1995 U.S. dollars) based on a review of several studies of caries rates in fluoridated vs. non-fluoridated communities. The paper estimates that fluoridation provides a net savings of anywhere from \$0.85 to \$33.71 per year.

⁵⁶ As evident by the studies of Yiamouyiannis (1990) and Brunelle and Carlos (1990), the difference in tooth decay between fluoridated and non-fluoridated populations, while detectable when calculated in terms of Decayed, Missing & Filled Surfaces (DMFS), is not large enough to be detectable when calculated in terms of Decayed, Missing and Filled Teeth (DMFT).

⁵⁷ A recent Canadian study by McLaren et al. (2016) reported an increase in decay following cessation of fluoridation in Calgary. However, as explained by Connett (2016), the entirety of this purported increase disappears when survey data omitted from the paper is considered.

⁵⁸ The average costs estimate is for people who had at least one restorative procedure during this time.

⁵⁹ See: <http://www.cdc.gov/nchs/fastats/life-expectancy.htm>

(Griffin et al. 2001, at 82, tbl. 4). Over the course of the average lifespan, this amounts to a lifetime savings ranging from \$67 to \$2656 per person when expressed in 1995 U.S. dollars. Adjusting for inflation, this amounts to a lifetime savings of \$106 to \$4,207 in 2016 dollars, which, even at its zenith, amounts to less than 20% of the costs (\$22,500) incurred from loss of a single IQ point

As discussed by Ko and Thiessen (2015), Griffin's cost-savings estimates suffer from several important limitations. First, and foremost, Griffin did not make any attempt to include the costs of treating dental fluorosis in the costs side of the ledger, thereby inflating the net savings. This is a particularly significant omission since Griffin elsewhere estimated, in a separate paper, that fluoridating water causes 2 percent of children to develop aesthetically objectionable fluorosis on their front teeth. (Griffin et al. 2002). With approximately 50 million children now living in fluoridated areas, this amounts to roughly 1 million children developing aesthetically objectionable fluorosis on their front teeth as a direct result of water fluoridation. But even this is an under-estimate, since Griffin based this on the NIDR's 1986-87 national survey, and more recent national surveys show that both the rate and severity of dental fluorosis have increased considerably over the past 20 years. (NHANES 2014; Beltran 2010). In fact, as mentioned earlier, the 2011-2012 NHANES survey found that an astonishing 21% of adolescents now have *moderate* fluorosis, and an additional 2% have severe fluorosis. (NHANES 2014) Since many children who have fluorosis staining on their front teeth will have it cosmetically treated,⁶⁰ the aggregate costs of this treatment will be substantial, and any cost-effectiveness evaluations of fluoridation that fail to account for these treatment costs will artificially inflate the cost-savings of fluoridation. Griffin's cost-savings estimates should not, therefore, be taken at face value, but even if they are, they suggest a range of lifetime savings for the current population under 18 (i.e., \$5.3 to \$210 billion) that is still substantially less than the range of earnings losses associated with fluoridation-related drops in IQ (i.e., \$11.1 billion to \$27.8 trillion).

C. Availability and Potential Hazards of Substitutes to Fluoridation Chemicals

The addition of fluoridation chemicals to drinking water began in the U.S. prior to the advent of topical fluoride products in an era when public health authorities believed fluoride's predominant benefit to teeth comes from *ingestion*. Things have changed dramatically since that time.

Today, over 95% of toothpastes contain fluoride, as do many other dental products, (CDC 2013c), and dental researchers now universally acknowledge that fluoride's predominant benefit is topical, not systemic. (E.g., Fejerskov 2004; Featherstone 2000). As explained in the *Journal of the American Dental Association*, "fluoride incorporated during tooth development is insufficient to play a significant role in cavity protection." (Featherstone 2000, at 891). The Centers for Disease Control has confirmed the primacy of fluoride's topical mechanisms, declaring that "fluoride's predominant effect is *posteruptive* and *topical*." (CDC 2001, at 4). The NRC has confirmed this as well, stating that "the major anticaries benefit of fluoride is *topical* and *not systemic*." (NRC 2006, at 13).

Since fluoride's primary benefit comes from topical contact with the teeth, there is little benefit from swallowing fluoride, in water or any other product. In fact, a recent study of the relationship between tooth decay and total daily fluoride ingestion failed to find a detectable relationship

⁶⁰ Research has found that teeth with dental fluorosis, including in its "mild" forms, is perceived as an objectionable condition that warrants dental treatment. (E.g., Alkhatib et al. 2004; Riordan 1993). Consistent with this, studies have repeatedly found that staining of the front teeth, including the white splotches of fluorosis, can cause children significant anxiety and distress about the appearance of their teeth. (E.g., Tellez et al. 2012; Marshman et al. 2008).

between the two. (Levy et al. 2009). Other recent studies investigating the relationship between tooth decay and individual biomarkers of fluoride intake (e.g., toenail fluoride content and dental fluorosis) have reported similar results. (Charone et al. 2012; Komarek et al. 2005).

The widespread availability of topical fluoride products highlights the lack of necessity of adding fluoridation chemicals to water, particularly since the quality of evidence for fluoride toothpastes has been recognized as vastly superior to the quality of evidence for water fluoridation.⁶¹ (Cheng et al. 2007, at 701). Furthermore, it is well established that western countries that do not fluoridate their water have tooth decay rates that are just as low, and often lower, as western countries that do fluoridate their water.⁶² (Cheng et al. 2007; Pizzo et al. 2007; Neurath 2005; Colquhoun 1997; Diesendorf et al. 1997; Bratthall et al. 1996; Diesendorf 1986).

While fluoride toothpastes and other fluoridated dental products carry their own potential hazards *when ingested*, these products—unlike drinking water—are not *designed* to be ingested. Further, unlike the addition of fluoridation chemicals to drinking water, the use of topical fluoride products does not result in the contamination of processed foods and beverages, thus making it easier to regulate the amount of fluoride ingested when topical fluoride products are the vehicle for delivering fluoride to those who want it.

D. Impacts on Industry, Employment & International Trade from Restricting Fluoridation Chemicals

Prohibiting the addition of fluoridation chemicals to drinking water will have little, if any, impact on industry, employment and international trade. The chemicals used for fluoridation are waste by-products of the U.S. phosphate industry and various Chinese fertilizer and chemical companies. The sale of fluoridation chemicals represents a very small portion of the U.S. phosphate industry's overall sales, and thus removing this very limited market will have little impact on the profitability of the phosphate industry. Finally, while ending fluoridation will curb *imports* of fluoridation chemicals from China, it will not impact American exports, because—to the best of Petitioners' knowledge—U.S. companies do not export fluoridation chemicals abroad. Accordingly, ending fluoridation will not have any disadvantageous impact on America's balance of trade.

XII. IT IS IN THE PUBLIC INTEREST FOR EPA TO ACT UNDER TSCA

EPA has recognized that TSCA invests the Agency with the authority to regulate drinking water additives. (EPA/FDA 1979). Although EPA also has certain authorities to regulate fluoride in drinking water under the SDWA, it is in the public interest for EPA to act under TSCA because it allows EPA to enact a far less expensive regulation that targets fluoridation chemicals in a more narrowly crafted manner that is justified on both policy and scientific grounds.

Under SDWA, the EPA can limit the legally permissible levels of chemicals in public drinking water supplies by enacting "Maximum Contaminant Levels" (MCLs). The EPA can effectively ban fluoridation under SDWA, therefore, by enacting an MCL below the so-called "optimal"

⁶¹ This is evident when comparing the Cochrane Collaboration's systematic review of the effectiveness of fluoride toothpastes with its systematic review of water fluoridation. *Compare* Iheozor-Ejiogor et al. (2015) *with* Marinho et al. (2003).

⁶² For additional data demonstrating the lack of difference in tooth decay rates between countries with extensive water (and/or salt) fluoridation and those without, Petitioners refer EPA to the documentation available at: <http://fluoridealert.org/studies/caries01/>

concentration of fluoride used in fluoridation programs (0.7 mg/L). Since an MCL does not distinguish, however, between fluoride that is *added* to water and fluoride that occurs naturally therein, implementing an MCL below the level used in fluoridation would force communities with elevated levels of naturally occurring fluoride to implement filtration programs. Banning fluoridation *indirectly* by reducing the MCL under SDWA would thus be more expansive in scope, and far more expensive in implementation, than a *direct* ban on fluoridation additives under TSCA.

As with other naturally occurring toxicants, like arsenic, Petitioners recognize that natural fluoride contamination of some rural water supplies is a problem that needs to be addressed. However, there is a distinct policy difference between a risk *imposed* on a population through the *purposeful addition* of a chemical to water, versus a risk that arises from a naturally occurring phenomena beyond human control. The difference between these two scenarios is material under TSCA because it speaks to the ease by which the risk can be eliminated, and thereby the *reasonableness* of continuing to endure the risk. Differential treatment of the two scenarios is thus justified.

Differential treatment is further justified by laboratory and epidemiological research linking artificial fluoridation chemicals (i.e., fluorosilicic acid and sodium fluorosilicate) with pipe corrosion and elevated blood lead levels. (Coplan et al. 2007; Maas et al. 2007; Macek et al. 2006; Masters et al. 2000). This research includes the CDC's own study of the issue, which analyzed the blood lead levels of children from the 1988-1994 National Health and Nutrition Examination Survey. (Macek et al. 2006).

Although the CDC study is sometimes touted as refuting the link between fluoridation and lead hazards, a close look at its data reveals that it is actually *consistent* with the fluorosilicate/lead thesis. As can be seen in Table 4 of the study, fluorosilicic acid was associated with:

- a 20% increased risk (but not statistically significant) for high blood lead levels among children living in houses made prior to 1946;
- a 40% increased risk (but not statistically significant) for high blood lead levels among children living in houses made between 1946 and 1973;
- a 70% increased risk (but not statistically significant) for high blood lead levels among children living in houses made after 1974;
- a 530% increased risk (which was statistically significant) for high blood lead levels among children living in houses with unknown ages.

Since three of these four elevated risks were not statistically significant, the CDC dismissed them as essentially random aberrations. However, the consistency in the *direction* of the risk, coupled with the large and significant five-fold increased risk for children in homes of unknown age, raises a serious red flag.

Even the CDC acknowledged that this study does not refute the connection between fluoridation and lead, and that "it is possible that larger samples might have identified additional, significant differences." (Macek et al. 2006, at 133). Indeed, when Coplan et al. re-analyzed CDC's data by placing all children exposed to fluorosilicic acid and sodium fluorosilicate in one group ("silicofluorides"), and all other children in another, they found that the children exposed to "silicofluoridated" water had a significantly elevated risk of having high blood lead levels. (Coplan et al. 2007, at 1039-40). According to Coplan's re-analysis, children from the silicofluoridated communities had a 20% greater risk of having blood lead levels in excess of 5

ug/dl. Coplan's team estimated that the risk for exceeding the 10 ug/dl threshold would be even greater. (*Id.* at 1039 tbl.9).

The repeated association between fluoridation chemicals and elevated blood levels provides further reason why it is in public interest for EPA to prioritize a targeted ban on fluoridation additives under TSCA over broad-based regulatory action against all fluoride in drinking water under SDWA.

XIII. CONCLUSION

Petitioners request that EPA exercise its authority under Section 6 of TSCA, 15 U.S.C. § 2605(a)(2), to prohibit the purposeful addition of fluoridation chemicals to U.S. water supplies. As set forth above, Petitioners make this request on the grounds that a large body of animal, cellular, and human research shows that fluoride is neurotoxic at doses within the range now seen in fluoridated communities. When considering the principles set forth in EPA's *Guidelines for Neurotoxicity Risk Assessment*, Petitioners submit that fluoridation is incompatible with a neurologically safe use of fluoride. Petitioners further make this request on the grounds that fluoride's predominant role in caries prevention comes from *topical* contact and thus there is no reasonable justification to expose hundreds of millions of Americans to the neurotoxic risks of *systemic* fluoride via water (and the many processed beverages and foods made therefrom) when topical fluoride products are now widely available for individual use. Most western nations, including the vast majority of western Europe, have already rejected water fluoridation. The EPA is the one federal agency with the authority to make this happen here in the U.S. We urge EPA to act accordingly.

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XIV. Bibliography

NOTE: For studies that were originally published in Chinese and later published in English, we use the date of English publication. For studies that were originally published in Chinese that have been translated into English but not yet republished, we use the date of the original study, not the date of translation.

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APPENDIX A:
Post-NRC Human Studies Investigating Fluoride's Impact on Cognition

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APPENDIX B:
Post-NRC Human Studies Investigating Fluoride's Impact on Fetal Brain

	Exhibit No.
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APPENDIX C:
Post-NRC Human Studies Investigating Fluoride’s Impact on Other Parameters of Neurotoxicity

	Exhibit No.
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**APPENDIX D:
Post-NRC Animal Studies Investigating Fluoride's
Neuroanatomical & Neurochemical Effects**

	Exhibit No.
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APPENDIX E:
Post-NRC Animal Studies Investigating Fluoride's Effect on Learning/Memory

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APPENDIX F:
Post-NRC Animal Studies Investigating Fluoride's Effect on Other Behavioral Parameters Beyond Learning/Memory

	Exhibit No.
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APPENDIX G:
Post-NRC In Vitro Studies Investigating Fluoride's Effect on Brain Cells

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UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA
AT SAN FRANCISCO

FOOD & WATER WATCH; AMERICAN)
ACADEMY OF ENVIRONMENTAL)
MEDICINE; FLUORIDE ACTION NETWORK;)
INTERNATIONAL ACADEMY OF ORAL)
MEDICINE & TOXICOLOGY; MOMS)
AGAINST FLUORIDATION; AUDREY)
ADAMS, individually and on behalf of KYLE)
ADAMS; KRISTIN LAVELLE, individually and)
on behalf of NEAL LAVELLE; and BRENDA)
STAUDENMAIER, individually and on behalf)
of KO STAUDENMAIER and HAYDEN)
STAUDENMAIER,)

Civ. No.

COMPLAINT

Plaintiffs,

vs.

U.S. ENVIRONMENTAL PROTECTION
AGENCY, an agency of the United States;
SCOTT PRUIT, Administrator, U.S.
Environmental Protection Agency, in his official
capacity,

Defendants.

1. Plaintiffs FOOD & WATER WATCH; AMERICAN ACADEMY OF ENVIRONMENTAL
MEDICINE; FLUORIDE ACTION NETWORK; INTERNATIONAL ACADEMY OF ORAL
MEDICINE & TOXICOLOGY; MOMS AGAINST FLUORIDATION; AUDREY ADAMS,
individually and on behalf of KYLE ADAMS; KRISTIN LAVELLE, individually and on behalf of
NEAL LAVELLE; and BRENDA STAUDENMAIER, individually and on behalf of KO
STAUDENMAIER and HAYDEN STAUDENMAIER (collectively "Plaintiffs") bring this suit against

1 Defendants, the U.S. ENVIRONMENTAL PROTECTION AGENCY and SCOTT PRUITT, in his
2 official capacity as Administrator of that Agency (collectively “EPA”), to compel the initiation of
3 rulemaking pursuant to the Toxic Substances Control Act (“TSCA”), 15 U.S.C. § 2605(a), to prohibit the
4 addition of fluoridation chemicals to drinking water supplies.

5 **I. BACKGROUND**

6 2. Industrial-grade fluoride chemicals (i.e., hydrofluorosilicic acid, sodium silicofluoride, and
7 sodium fluoride), derived primarily from the phosphate fertilizer industry, are added to many public
8 water supplies in the United States in an attempt to reduce tooth decay.

9 3. Approximately 200 million Americans live in communities with artificially fluoridated water.
10 Even people who don’t live in fluoridated areas now regularly consume fluoridated water since many
11 processed foods and beverages are made in fluoridated areas.

12 4. Water fluoridation began in the 1940s based on the mistaken premise that fluoride’s primary
13 benefit to teeth comes from *ingestion*.

14 5. It is now universally recognized by dental researchers, including the Centers for Disease
15 Control’s (CDC) Oral Health Division, that fluoride’s primary benefit comes from *topical* application.
16 Fluoride does not need to be *swallowed*, therefore, to prevent tooth decay.

17 6. The National Academy of Sciences (NAS) has repeatedly stated that fluoride is not an essential
18 nutrient. Fluoride does not need to be swallowed, therefore, to prevent *any disease* or promote *any health*
19 *benefit*.

20 7. Water fluoridation has been rejected or discontinued by the vast majority of European countries
21 without any demonstrated adverse effect on cavity rates.

22 8. Whereas fluoride’s benefits to teeth come from topical contact, fluoride’s health risks come
23 from ingestion. One of the risks of fluoride ingestion is dental fluorosis, a hypomineralization of tooth
24 enamel that produces noticeable discoloration of the teeth.
25
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1 9. According to a 2011-2012 national survey by the CDC, a staggering 58% of American
2 adolescents now have dental fluorosis, with 23% of adolescents suffering advanced forms of the
3 condition. When present on the front teeth, dental fluorosis (even in its “mild” forms) is an aesthetically
4 objectionable condition that can cause children significant social anxiety and embarrassment.

5 10. The rate of dental fluorosis among U.S. children is far higher today than was the case when
6 fluoridation first began in the 1940s, and is several times higher than the rate documented in the 1980s.
7 The continued increase in fluorosis over the past 60 years highlights the fact that American children are
8 being exposed to unprecedentedly high doses of fluoride, primarily but not exclusively through water
9 fluoridation.
10

11 11. The prevalence and severity of dental fluorosis is significantly greater in areas with fluoridated
12 water than in areas without. This is because children in fluoridated areas receive larger cumulative doses
13 of fluoride than children in non-fluoridated areas.

14 12. A primary concern with fluoride’s impact on human health today is its deleterious effect on the
15 brain.
16

17 13. In 2006, the National Research Council (NRC) concluded that “it is apparent that fluorides have
18 the ability to interfere with the functions of the brain.”

19 14. Over 300 published, peer-reviewed studies have reported that fluoride interferes with the brain.
20 This includes over 50 studies linking fluoride exposure to cognitive impairments in human populations.
21 The majority of these studies have been published within the past 10 years.
22

23 15. In 2014, fluoride was added to the list of chemicals “*known* to cause developmental neurotoxicity
24 in *human beings*” in a review published by *Lancet Neurology*. Fluoride is one of only 12 chemicals that
25 are on this list, alongside lead, mercury, and PCBs.

26 16. Many of the studies investigating fluoride’s impact on the brain have found adverse neurotoxic
27 effects at doses ingested by a large number of Americans living in fluoridated communities.
28

1 17. EPA's safety standards for fluoride dosing remain focused on preventing severe dental fluorosis
2 and/or crippling skeletal fluorosis, and do not account for fluoride's effects on the brain. Yet, studies in
3 humans and animals show that fluoride causes adverse neurotoxic effects at doses that are *lower* than
4 those which produce severe dental and skeletal fluorosis. Safety standards solely designed to protect
5 against severe dental and skeletal fluorosis will thus not protect against fluoride's neurological effects.

6 18. EPA has promulgated *Guidelines for Neurotoxicity Risk Assessment* (hereafter, *Guidelines*),
7 which set forth the principles, concepts, and procedures that EPA has stated it "will follow" when
8 "evaluating data on potential neurotoxicity associated with exposure to environmental toxicants."
9

10 19. Despite the voluminous peer-reviewed scientific literature on fluoride neurotoxicity in humans,
11 animals, and cell cultures, EPA has never applied its own *Guidelines* to fluoride.

12 20. Application of EPA's *Guidelines* to the human, animal, and in vitro research on fluoride
13 neurotoxicity would show that (1) neurotoxicity is a hazard of fluoride exposure, and (2) the risk of this
14 hazard exists at doses that are now ingested by millions of Americans living in fluoridated communities.

15 21. Neurodevelopmental disabilities, including learning disabilities and attention deficit hyperactivity
16 disorder, are now widespread in the United States. Data from the CDC shows that 1 in 6 U.S. children
17 now suffer from a neurodevelopmental disability.
18

19 22. In a nation besieged by neurological disorders of poorly understood etiology, both in young
20 children and the elderly, minimizing exposures to known neurotoxic substances must be a public health
21 priority.
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II. JURISDICTION AND VENUE

1
2 24. On November 22, 2016, a group of organizations and individuals, including Plaintiffs, petitioned
3 EPA to exercise its authority under Section 6 of TSCA, 15 U.S.C. § 2605, to prohibit the addition of
4 “fluoridation chemicals” to drinking water supplies based on the voluminous peer-reviewed research
5 linking fluoride exposure to neurotoxicity. (The one and only chemical use of “*fluoridation* chemicals”
6 is to fluoridate drinking water.)

7 25. By letter dated February 17, 2017, EPA denied the Petition.

8
9 26. Plaintiffs have a right to bring this action pursuant to TSCA, 15 U.S.C. § 2620(b)(4), which
10 authorizes petitioners to commence a civil action in a district court of the United States to compel the
11 EPA Administrator to initiate a rulemaking proceeding as requested in the petition.

12 27. This Court has jurisdiction pursuant to 15 U.S.C. § 2620(b)(4)(A) and 28 U.S.C. § 1331.

13 28. Venue is properly vested in this Court under 28 U.S.C. § 1391(e) as Plaintiff KRISTIN
14 LAVELLE resides in Berkeley California, and Plaintiff FOOD & WATER WATCH has a regional office
15 in Oakland, California.

16
17 **III. PARTIES**

18 29. Plaintiff FOOD & WATER WATCH (“FWW”) is a national, non-profit, public interest consumer
19 advocacy organization with its headquarters in Washington, D.C. and a regional office in Oakland,
20 California.

21 30. FWW’s mission includes educating consumers about the health and safety of our food and water
22 systems and as such FWW advocates on behalf of the public for policies promoting environmental
23 protection and the long-term well-being of individuals and communities.

24
25 31. FWW’s members live in fluoridated communities across the United States, and as with virtually
26 all Americans, regularly purchase processed foods and beverages that are contaminated with fluoridated
27 water. Since the labels on processed foods and beverages do not identify whether the products are made
28

1 with fluoridated water, it is often not possible for consumers to know which particular food or beverage
2 is contaminated. There is therefore a credible threat that FWW's members will be exposed to fluoridated
3 water and the health risks associated therewith, even if they purchase home water filtration systems to
4 remove the fluoride out of the tap water entering their homes.

5 32. Jessica Trader is an FWW member and a San Francisco business owner. San Francisco adds
6 industrial fluoride chemicals to its water. Jessica has moderate-to-severe dental fluorosis from over-
7 exposure to fluoride as a child. As a result of her fluorosis, Jessica's teeth have noticeable white and
8 brown stains, which have caused her social anxiety and embarrassment. Jessica is concerned about the
9 impact that her prior and ongoing exposures to fluoridation chemicals could have on her health and has
10 spent significant money in order to limit her exposure to this toxicant, including through the purchase and
11 installation of a professional water filtration system that removes fluoride.
12

13 33. Dayna Stephens is a FWW member and professional saxophonist. Dayna currently resides in
14 Patterson, New Jersey. Although Patterson does not fluoridate its water, Dayna's musical career requires
15 him to spend a large percentage of his time travelling throughout the United States. Dayna suffers from
16 Focal Segment Glumereal Sclerosis (FSGS), a cause of kidney disease in children and adolescents as
17 well as a leading cause of kidney failure in adults. Dayna underwent dialysis for his kidney failure and
18 underwent kidney transplant surgery. It is well established in the scientific literature that kidney disease
19 greatly increases an individual's susceptibility to fluoride's toxicity. Dayna is aware of this research, and
20 is very concerned about the impact fluoride ingestion could have on his health. While at home, and while
21 travelling, Dayna spends a significant amount of time and money to avoid exposure to fluoridation
22 chemicals from tap water, processed foods, and processed beverages.
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25 34. Rosemary Fletcher is an FWW member and resident of Greenville, South Carolina, which adds
26 industrial fluoride chemicals to its water. Rosemary is an African American woman on a fixed income
27 who used to be dependent on a wheel chair due to a painful arthritic condition. After learning that her
28

1 condition could be exacerbated by fluoride exposure, Rosemary stopped drinking fluoridated water and
2 experienced a major improvement in her symptoms. After several months of diligently eliminating
3 fluoridated water, Rosemary was able to abandon her wheel chair, and has not needed it since. Rosemary
4 continues to take every measure possible to avoid exposure to fluoridated water, including by purchasing
5 bottled water for her home drinking water needs. Rosemary's reliance on bottled water has created a
6 financial hardship for her, as she has very limited financial resources.

7 35. Franzi and Randy Talley are FWW members, restaurant owners, and residents of Asheville,
8 North Carolina, which adds industrial fluoride chemicals to its water. Approximately nine years ago,
9 Franzi was diagnosed with breast cancer, which she treated with chemotherapy. Subsequent to
10 chemotherapy, tests revealed that Franzi had an underactive thyroid gland, as evident by low circulating
11 thyroid hormone levels in her blood. The low thyroid function persisted for years, and was accompanied
12 by substantial fatigue. Last year, after learning of credible medical science linking fluoride exposure to
13 decreased thyroid function, Franzi stopped drinking the fluoridated city water. Franzi's thyroid hormone
14 levels began to increase within months of making this switch, and are now almost back to normal.
15 Franzi's energy level has also notably improved during this time as well. Avoiding fluoridated water is
16 therefore a critical health priority for Franzi as she seeks to continue her recovery. Both her and her
17 husband Randy continue to diligently do what they can to avoid fluoridated water, both for themselves
18 and the customers they serve. They would like to install a water filtration system at their restaurants
19 which can remove the fluoride, but they have run into technical difficulties implementing a filtration
20 system that is capable of removing fluoride that is also compatible with their operations.
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22
23 36. Karen Spencer is an FWW member and resident of Gloucester, Massachusetts which adds
24 industrial fluoride chemicals to its water. Karen long suffered from various health problems beginning
25 the month her city began fluoridation in 1981. Her symptoms include rashes, hives, gastrointestinal
26 problems, arthritis, general fatigue, pain, chronic dizziness and intermittent short periods of profound,
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1 debilitating and overwhelming fatigue. In 2014, Karen began to strictly eliminate her exposure to
2 fluoridated water to see if it would improve her health. In 9 days, she noted a dramatic improvement in
3 all her symptoms, including cessation her neurological symptoms. Karen has continued to strictly avoid
4 fluoridated water and food and has made a recovery from the illnesses that caused her decades of misery.

5 37. Plaintiff FLUORIDE ACTION NETWORK (“FAN”) is a project of the American Environmental
6 Health Studies Project, Inc. FAN is an organization of scientists, doctors, dentists, environmental health
7 researchers, and concerned citizens working to raise awareness about the impact of current fluoride
8 exposures on human health. FAN’s members live in fluoridated communities across the United States,
9 and many have expended significant sums of money to avoid the fluoride added to tap water and
10 processed foods and beverages. Many of FAN members have suffered dental fluorosis and other harm as
11 a result of their fluoride exposures, and have credible concerns about the impact that ongoing exposures
12 to fluoridated water will have on their health.
13

14 38. Julie Simms is a FAN member, FWW member, and resident of Seattle, Washington, which adds
15 industrial fluoride chemicals to its water. For more than a decade, Julie experienced constant, daily
16 headaches. She experimented with numerous therapies to cure her of the condition, but nothing worked.
17 Then, in 2013, a friend suggested that Julie stop drinking fluoridated water. Julie was very skeptical of
18 this suggestion as she had long been a supporter of water fluoridation, believed in its safety and efficacy.
19 Nevertheless, at the insistence of her friend, Julie stopped drinking fluoridated water and to her great
20 surprise, the headaches became substantially less painful within just 3 days, and were completely gone
21 within weeks. Julie has continued to spend the necessary resources to avoid fluoridated water and
22 consequently her daily headaches have not returned. Based on her experience, Julie’s doctor has advised
23 that she continue to refrain from fluoridated water, not just for drinking and cooking, but bathing as well.
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1 39. Plaintiff AUDREY ADAMS, individually and on behalf of her son KYLE ADAMS, resides in
2 Renton Washington. The Adams are served by Soos Creek Water and Sewer District, a wholesale water
3 purveyor receiving pre-treated water from Seattle Public Utilities (“SPU”). SPU adds industrial fluoride
4 chemicals to its water supply. Kyle has autism and has specific metabolic weaknesses that heighten his
5 sensitivity to many chemicals, including fluoride. Kyle’s doctor concurs that Kyle must refrain from
6 exposure to fluoridated water for drinking, cooking and bathing, as he has a consistent history of
7 suffering severe reactions when exposed to fluoridated water. These reactions include (but are not
8 limited to) intense pain and headaches, with resulting extreme hyperactivity, accelerated heart rate and
9 intensification of autistic symptoms. Audrey Adams continues to expend substantial time and money
10 ensuring that Kyle is not exposed to fluoridated water, including the ongoing purchase of spring water
11 and reverse osmosis filtered water for all drinking and cooking and special water filtration for showering.
12 Kyle’s continued ability to work, recreate, communicate, participate in community outings and even to
13 sleep are reliant on strict avoidance of all sources of fluoridated water.

14 40. Plaintiff KRISTIN LAVELLE, individually and on behalf of her 12-year-old son NEAL
15 LAVELLE, is a resident of Berkeley, California. Kristin is an occupational health therapist, and is
16 concerned about the adverse effects that fluoride exposures could have on her and her family’s health,
17 including her son Neal. Since Berkeley adds industrial fluoride chemicals to its water, Kristin purchased
18 a \$2,000 whole house water filtration system in May of 2015. Although the filter was advertized to
19 reduce over 80% of the fluoride, and although Kristin has dutifully followed all of the maintenance
20 requirements, recent test results show that the filter is not removing any of the fluoride. Kristin has thus
21 purchased a new countertop water filter, which will require ongoing replacements of the filter cartridge,
22 and is considering purchasing a replacement filtration system. In addition to the expenses that Kristin
23 has incurred in trying to remove the fluoride chemicals from her tap water, Kristin also spends significant
24 time and money to minimize her and Neal’s exposure to fluoridated water when away from home.
25
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1 41. Plaintiff BRENDA STAUDENMAIER, individually and on behalf of her children KO
2 STAUDENMAIER and HAYDEN STAUDENMAIER, is a resident of Green Bay, Wisconsin, which
3 adds industrial fluoride chemicals to its water. Due to her concerns about the impact of fluoride on her
4 and her children's health, Brenda has purchased a water filtration system to filter the fluoride out of the
5 water. The filtration system requires that the filter cartridges be replaced approximately every six
6 months. Each cartridge costs approximately \$137.50, so Brenda has to pay approximately \$275 a year to
7 ensure access to fluoride-free water at home. Brenda is a single mother living on a low income, and \$275
8 a year represents a substantial expense for her.

9
10 42. Plaintiff AMERICAN ACADEMY OF ENVIRONMENTAL MEDICINE was founded in 1965,
11 and is an international association of physicians and other professionals that provides research and
12 education in the recognition, treatment and prevention of illnesses induced by exposures to biological and
13 chemical agents encountered in air, food and water.

14 43. Plaintiff INTERNATIONAL ACADEMY OF ORAL MEDICINE & TOXICOLOGY
15 ("IAOMT") has been dedicated to its mission of protecting public health through the practice of
16 biological dentistry since it was founded in 1984. A worldwide organization of over 800 dentists,
17 physicians, and research professionals in more than 14 countries, IAOMT's mission is accomplished by
18 funding and promoting relevant research, accumulating and disseminating scientific information,
19 investigating and promoting non-invasive scientifically valid therapies, and educating medical
20 professionals, policy makers, and the general public.

21
22 44. Plaintiff MOMS AGAINST FLUORIDATION ("MOMS") is a nonprofit organization
23 that educates mothers, pregnant women, families, medical professionals, and all citizens about the now
24 known health effects and ethical issues of ingesting artificial fluoridation chemicals to our water supply.
25 MOMS takes the position that using the public's drinking water to deliver a drug in indiscriminate doses
26 that vary widely from person to person without is a violation of the medical right to informed consent.
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IV. STATUTORY FRAMEWORK

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3 45. Section 6 of the Toxic Substances Control Act (TSCA) invests EPA with the authority and duty
4 to take certain prescribed actions if it determines that “the manufacture, processing, distribution in
5 commerce, use, or disposal of a chemical substance . . . presents an unreasonable risk of injury to health.”
6 15 U.S.C. § 2605(a). In making this determination, TSCA commands that EPA consider not only risks to
7 the general public, but to “susceptible subpopulation[s]” as well. 15 U.S.C. § 2605(b)(4)(A).

8 46. TSCA commands that EPA conduct its risk evaluation “without consideration of costs or other
9 nonrisk factors.” 15 U.S.C. § 2605(b)(4)(A).

10
11 47. If EPA determines that a chemical substance presents an unreasonable risk to the general public
12 or susceptible subpopulation(s), the Agency “shall” take action “to the extent necessary to protect
13 adequately against such risk using the least burdensome requirements.” 15 U.S.C. § 2605(a). The
14 actions that EPA may take include: (1) prohibiting the manufacture and distribution of the substance for a
15 “particular use,” and (2) prohibiting “any manner or method of commercial use” of the substance. 15
16 U.S.C. § 2605(a)(2) & (5).

17 48. EPA’s authority to prohibit and regulate the use of chemical substances under TSCA
18 encompasses drinking water additives. EPA recognized this in its June 12, 1979 Memorandum of
19 Understanding (MOU) with the FDA, in which the Agency stated unequivocally that it has authority “to
20 regulate direct and indirect *additives to drinking water* as chemical substances and mixtures under
21 TSCA.” As EPA explained in the MOU, “[a]lthough Section 3(2)(B) of TSCA excludes from the
22 definition of ‘chemical substance’ food and additives as defined under FFDCA, the implicit repeal by the
23 [Safe Drinking Water Act] of FDA’s authority over drinking water enables EPA to regulate direct and
24 indirect additives to drinking water as chemical substances and mixtures under TSCA.”
25

26
27 49. In proposing and promulgating a rule under 15 U.S.C. § 2605(a), the EPA shall consider and
28

1 publish a statement addressing, inter alia, the (A) the effects of the chemical substance on human health
2 and the exposure of human beings to it; (B) the benefits of the chemical substance; and (C) the
3 reasonably ascertainable economic consequences of the rule. 15 U.S.C. § 2605(c)(2)(A).

4 5 V. STATEMENT OF FACTS

6 A. The National Research Council's 2006 Review and Subsequent Peer-Reviewed Research 7 Demonstrates Fluoride's Ability to Harm the Brain

8 50. In 2003, the EPA asked the National Research Council (NRC) to review the adequacy of EPA's
9 Maximum Contaminant Level Goal (MCLG) for fluoride, which then and now is set at 4 mg/L. In
10 response, the NRC reviewed the existing research on fluoride toxicity and concluded, in March 2006,
11 that the MCLG is not protective of public health and should be lowered.
12

13 51. The NRC conclusion was based on fluoride's adverse effects on bone and teeth, but the NRC also
14 raised numerous concerns about the potential for fluoride to cause other systemic harm, particularly to
15 the endocrine and nervous systems.

16 52. With respect to the endocrine system, the NRC concluded that fluoride is an "endocrine
17 disrupter," that can alter the function of numerous endocrine glands in the body, including the thyroid
18 gland. The NRC reviewed numerous studies linking fluoride to altered thyroid function, noting that "[i]n
19 humans, effects on thyroid function were associated with fluoride exposures of 0.05-0.13 mg/kg/day
20 when iodine intake was adequate and 0.01-0.03 mg/kg/day when iodine intake was inadequate." These
21 doses are ingested by many people living in fluoridated areas. In light of the established link between
22 thyroid function and neurological health, the NRC called for more research into fluoride's role "in the
23 development of several diseases or mental states in the United States."
24

25 53. With respect to the nervous system, the NRC concluded: "On the basis of information largely
26 derived from histological, chemical, and molecular studies, it is apparent that fluorides have the ability to
27 interfere with the functions of the brain."
28

1 54. The NRC's conclusion about fluoride's interference with the brain rested primarily on its review
2 of animal studies, because few human studies were available at the time of the NRC review. In the last
3 decade, however, many studies have reported links between fluoride exposure and cognitive deficits in
4 humans, providing additional foundation for concerns about fluoride's threats to the brain.

5 55. At the time, the NRC only had five human studies on fluoride's cognitive effects to consider in
6 drawing its conclusions; however, there are now over 50 studies linking fluoride to cognitive deficits in
7 humans, as reflected by reduced IQ scores, impaired performance on the Neurobehavioral Core Test
8 Battery (NCTB) test, and impaired performance on the Rey Osterrieth Complex Figure test. In addition,
9 at least three studies have found that the human fetal brain is damaged by elevated prenatal fluoride
10 exposures, which may be one of the mechanisms by which fluoride lowers IQ.

11 56. The evidence linking fluoride to neurotoxicity in humans is far more extensive today than it was
12 when NRC published its review in 2006, and is far more extensive than the evidence for most of the
13 other chemicals known or suspected to be neurotoxins. Despite this fluoride continues to be used as a
14 water additive.
15

16 57. A recent systematic review of suspected developmental neurotoxins by EPA scientists found that
17 few chemicals have been linked to neurotoxicity in humans. The EPA scientists stated that chemicals
18 linked to neurotoxicity in humans are "gold standard" chemicals that warrant prioritization.
19

20 58. In the case of fluoride, not only is there human data on neurotoxicity, there are so many human
21 studies linking fluoride to neurotoxic effects that fluoride has been classified by experts as one of only 12
22 chemicals "*known to cause developmental neurotoxicity in human beings.*"
23

24 59. Fluoride's ability to impair cognition in humans is consistent with animal studies showing that
25 fluoride exposure impairs learning and/or memory capacity in rodents under carefully controlled
26 laboratory conditions. There are now at least 45 animal studies linking fluoride to cognitive deficits in
27 rodents.
28

1 60. Fluoride's ability to harm the brain has been further confirmed by over 100 animal studies
2 published since the NRC review which show that fluoride exposure produces a range of adverse
3 neuroanatomical and neurochemical alterations in the brain, including at concentrations that humans
4 experience in fluoridated areas in the United States.

5 61. It has been 10 years since the NRC determined that the MCLG for fluoride be lowered based on
6 the available data, and the data has continued to mount exponentially, but the EPA has ignored NRC's
7 recommendations and failed to act to protect the public health.
8

9 **B. Fluoride Poses Neurotoxic Risks at Doses Comparable to the Doses Ingested in Fluoridated**
10 **Communities in the United States**
11

12 62. A frequent claim made by those who continue to promote fluoridation is that the water fluoride
13 concentrations associated with neurotoxicity in humans are not relevant to the water fluoride
14 concentrations in the United States; that the drinking water concentrations linked to neurotoxicity exceed
15 the concentration used in domestic water fluoridation programs (0.7 mg/L).
16

17 63. In support of this claim, proponents of fluoridation often point to the *highest* water fluoride
18 concentrations that have been linked to neurotoxicity, while ignoring the *lowest* concentrations (and even
19 the *typical* concentrations) that have been associated with harm.

20 64. This focus on the *highest* concentrations that cause harm as the starting point for analysis, rather
21 than the lowest concentrations, clashes with standard tenets of risk assessment, including EPA's
22 *Guidelines*.
23

24 65. The focus on the water fluoride *concentrations* associated with neurotoxic harm also overlooks
25 the fact that it is the total daily *dose* of fluoride that causes toxicity (i.e., how much fluoride a person
26 actually ingests), not simply the concentration of fluoride in the water. For example, a person consuming
27 two liters of water containing 0.7 mg/L fluoride (the concentration used in fluoridation programs) will
28

1 consume the same waterborne dose as a person consuming water with 1.4 mg/L (a concentration that has
2 repeatedly been linked to IQ loss). Some Americans, including athletes, manual laborers, and diabetics,
3 consume large quantities of water, far in excess of two liters a day. Further, many of the studies which
4 have investigated fluoride's impact on IQ have been conducted in rural China, where very few children
5 are exposed to fluoride toothpaste and other fluoridated dental products. Since the vast majority of
6 American children use fluoridated dental products, and since use of fluoridated dental products during
7 the early years of life can result in substantial fluoride ingestion, an American child can receive the same
8 daily dose of fluoride as a Chinese child despite having less fluoride in the water.
9

10 66. Contrary to the oft-repeated claim that fluoride neurotoxicity is only found at irrelevantly high
11 water fluoride concentrations, the existing studies of fluoride-exposed human populations consistently
12 find neurotoxic impacts within water fluoride concentrations that the EPA currently considers safe (≤ 4
13 milligrams/liter), with many of these studies finding IQ loss at just 0.8 to 2 mg/L.

14 67. In total, there are 24 published studies reporting statistically significant reductions in IQ in areas
15 with water fluoride concentrations less than the EPA's MCLG.
16

17 68. Many of the studies investigating fluoride's effect on IQ have provided individual-level data on
18 fluoride exposure, including: (a) daily fluoride dose from all sources, (b) urine fluoride level, (c) serum
19 fluoride level, and (d) dental fluorosis status. Each of these metrics have been found to correlate with
20 reduced IQ.

21 69. The *daily fluoride dose* associated with reduced IQ in endemic fluorosis areas is exceeded by
22 many Americans living in fluoridated areas.
23

24 70. The *urine fluoride level* associated with reduced IQ in children in endemic fluorosis areas is
25 exceeded by many Americans living in fluoridated areas.

26 71. The *urine fluoride level* associated with cognitive impairment in adults in endemic fluorosis areas
27 is exceeded by many Americans living in fluoridated areas.
28

1 72. The *serum fluoride level* associated with reduced IQ in endemic fluorosis areas is exceeded by
2 many Americans living in fluoridated areas.

3 73. Studies have found that children with mild, moderate, and moderate/severe fluorosis have lower
4 IQs than children with no fluorosis. Consistent with this, studies of rodents have repeatedly found
5 neurotoxic effects, including learning impairments, among rats with only mild forms of fluorosis. As
6 noted by Niu, et al, “these findings indicate that fluoride . . . can influence spontaneous behaviors and
7 lower the learning ability of rats *before the appearance of dental lesions.*”
8

9 74. The studies linking fluorosis to cognitive deficits become extremely significant to the question of
10 U.S. regulatory policy when considering the rate of dental fluorosis among the U.S. population.

11 75. CDC’s 2011-2012 National Health and Nutrition Examination Survey (NHANES) found dental
12 fluorosis in 58.3% of the surveyed adolescents, including an astonishing 21.2% with moderate fluorosis,
13 and 2% with severe. Since there are an estimated 42-million adolescents currently living in the U.S., the
14 NHANES data suggests that up to 24-million adolescents now have some form of dental fluorosis, with
15 over 8 million adolescents having moderate fluorosis, and 840,000 having severe fluorosis.
16

17 76. The NHANES survey does not provide data on the respective rates of fluorosis in fluoridated vs.
18 non-fluoridated communities, but research has repeatedly confirmed that both the prevalence and severity
19 of dental fluorosis are greater in U.S. communities with fluoridated water than in communities without.
20 Stopping the addition of fluoride to drinking water will thus reduce the number of children developing
21 dental fluorosis, and the accompanying neurotoxic risks associated with the doses that produce fluorosis.
22

23 77. Recent epidemiological studies in Canada, England, and the United States provide further reason
24 for concern about the neurotoxic dangers posed by fluoridation. In 2016, researchers from Canada found
25 that urinary fluoride levels were significantly correlated with learning problems. In 2015, Malin and Till
26 found a significant correlation between the prevalence of water fluoridation at the state level in the U.S.
27 and Attention-Deficit Hyperactivity Disorder (ADHD). Another 2015 study, by Peckham et al., found
28

1 that fluoride levels greater than 0.7 mg/L significantly correlated with higher rates of hypothyroidism in
2 the United Kingdom, even after controlling for the covariates of age, gender, and index of deprivation.
3 The correlation between fluoridation and hypothyroidism, which is biologically plausible and consistent
4 with prior animal and human studies, provides further mechanistic support for the capacity of fluoridated
5 water to cause neurotoxic effects. Finally, recent epidemiological and laboratory studies strongly suggest
6 that fluoridating water with hydrofluorosilicic acid increases the corrosion of lead (a potent neurotoxin)
7 from brass pipes and fittings, resulting in elevated blood lead levels. This provides yet another
8 mechanism whereby fluoridation can produce adverse neurotoxic effects at relevant use and exposure
9 levels.
10

11 78. Studies of rodents further demonstrate the neurotoxic hazards of the fluoride doses ingested in
12 fluoridated areas. The National Toxicology Program has estimated that over 10% of children living in
13 fluoridated areas will receive a comparable waterborne fluoride dose as rats drinking water with 9 mg/L.
14 This is significant because studies have repeatedly found neurotoxic effects among rats drinking water
15 with just 1 to 9 mg/L; including oxidative stress, alterations in neurotransmitters, learning impairment,
16 behavioral changes, and pathological changes in the synaptic structure.
17

18 79. Studies of cells have found that fluoride can damage brain cells at concentrations as low as 9 parts
19 per *billion*. Most Americans living in fluoridated areas have more than 9 parts per billion fluoride in
20 their blood, with some individuals having 50 to 100+ parts per billion in their blood. Since fluoride
21 circulating in the blood has access to the brain, and since the blood brain barrier loses its efficacy with
22 aging, many Americans will have fluoride levels in their brain that are known to harm brain cells in
23 carefully controlled laboratory experiments.
24
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C. Susceptible Subpopulations Are at Heightened Risk of Fluoride Neurotoxicity

1
2 80. EPA's *Guidelines* recognize that individual susceptibility to the neurotoxicity of environmental
3 toxicants can vary by a factor of ten or more, and is influenced by factors such as nutritional status, age,
4 genetics, co-exposure to other toxicants, and disease.

5 81. Each of these factors—nutritional status, age, genetics, co-exposure to other toxicants, and
6 disease—are known to influence an individual's susceptibility to chronic fluoride toxicity.

7
8 82. Recent research has specifically demonstrated that nutrient deficiencies and genetics amplify
9 fluoride's neurotoxicity. Zhang et al. (2015), for example, reported that certain COMT gene
10 polymorphisms greatly influence the extent of IQ loss resulting from fluoride exposure, which is
11 consistent with research on other neurotoxins, including methyl mercury.

12 83. While the full range of individual susceptibility to fluoride neurotoxicity in the U.S. cannot be
13 precisely calculated, a number of identifiable subpopulations are clearly at elevated risk, including:

14
15 a. **Infants:** Although *breast fed* infants receive the lowest fluoride intake by bodyweight
16 (<0.001 mg/kg/day) of all age-groups, this situation is flipped on its head when infants are
17 fed *formula reconstituted with fluoridated water*, as infants consuming fluoridated
18 formula receive the highest dosage of any age group in the population. In fact, the
19 average daily dose received by an infant receiving fluoridated formula *exceeds* the dose
20 that has been associated with reduced IQ in studies of Chinese children. Not only do
21 formula-fed infants receive an unnaturally high dose, they have an impaired ability to
22 excrete the fluoride they ingest, retaining up to 87% of the absorbed dose. As a result of
23 this high body burden, infants exposed to fluoridated water suffer far higher rates of dental
24 fluorosis, thus demonstrating their vulnerability to fluoride's systemic effects.

25
26 b. **Elderly:** As noted in EPA's *Guidelines*, "[T]he aged population is considered to be at
27 particular risk [of neurotoxicity] because of the limited ability of the nervous system to
28

1 regenerate or compensate to neurotoxic insult.” This is of concern because the brain will
2 be more exposed to fluoride in older age due to the (1) increased level of fluoride
3 circulating in the serum as a result of age-related degenerations in kidney and bone health,
4 and (2) increased permeability of the blood-brain barrier. Consistent with this, studies
5 have found a very high prevalence of cognitive impairment (up to 82%) among elderly
6 individuals in endemic fluorosis areas.

7
8 c. ***Individuals with suboptimal nutrient intake:*** It has been known for over 70 years that
9 suboptimal nutrient intake (e.g., calcium, vitamin C, vitamin D, iodine, etc) render
10 individuals more susceptible to fluoride toxicity. This is of significant concern vis-à-vis
11 fluoride neurotoxicity in the U.S. as suboptimal nutrient intake remains a widespread
12 problem. For example, 86% percent of African Americans, for example, do not get
13 enough calcium; the median urine iodine concentrations for women of child-bearing age
14 “border on insufficiency”; and 6% of Americans have a vitamin C deficiency.

15
16 d. ***Individuals with COMT gene polymorphisms:*** The study by Zhang et al. (2015) suggests
17 that children with the COMT val/val genotype suffered a five-fold larger drop in IQ than
18 children with the COMT val/met and met/met genotypes.

19
20 e. ***Individuals with kidney disease:*** The kidneys are the principal way that the human
21 excretes fluoride. When the kidneys are damaged, the ability to excrete fluoride becomes
22 impaired, leading to an excess accumulation of fluoride in the body. It is well established,
23 therefore, that individuals with advanced kidney disease are at far higher risk of suffering
24 fluoride toxicity.

25
26 f. ***African Americans:*** The African American community suffers disproportionate risks
27 from fluoride exposure, as it has a heightened prevalence of multiple risk factors for
28 fluoride toxicity, including elevated use of infant formula, elevated exposure to lead,

1 depressed calcium and anti-oxidant intake, and significantly higher rates of dental
2 fluorosis, including in its moderate and severe forms.

3 84. These susceptible subpopulations will suffer neurotoxic effects at doses of fluoride exposure that
4 are lower than the general population.

5
6 **D. A Reference Dose Protective Against Fluoride Neurotoxicity Is Incompatible with Water**
7 **Fluoridation if Standard Risk Assessment Procedures Are Applied**

8 85. Because of the wide range of sensitivity in the human population to neurotoxicants, EPA's
9 Guidelines endorse the application of "uncertainty factors" (UF) when converting the "lowest observable
10 adverse effect level" (LOAEL), "no observable adverse effect level" (NOAEL) or Benchmark Dose
11 (BMD) level into a safe "reference dose" (RfD). Typically, the uncertainty factors are at least one order
12 of magnitude (i.e., a factor of 10).

13
14 86. Application of a *single* uncertainty factor of 10 to the dose of fluoride associated with harm
15 and/or the doses associated with no effect, produce RfD that is far below the levels that most Americans
16 now receive in fluoridated areas. The dose that would protect against fluoride neurotoxicity according to
17 EPA's Guidelines, and standard risk assessment procedures, is incompatible with the doses of fluoride
18 ingested in fluoridated areas.

19 87. Application of EPA's BMD methodology to available dose-response data (Xiang et al.) indicates
20 that ingestion of 0.7 mg fluoride per day is associated with an average loss of 2.5 IQ points when
21 compared to a child with no fluoride exposure. This is a dose of fluoride that tens of millions of
22 American children living in fluoridated communities now ingest.

23
24 88. A recent published quantitative risk analysis by a former Senior EPA risk assessment scientist
25 concludes that fluoride ingestion should be kept below 0.05 mg/day if neurotoxicity is to be avoided.
26 Virtually every person living in a fluoridated area consumes more than 0.05 mg/day from fluoridated tap
27 water and processed foods and beverages made with fluoridated water.
28

1 89. The reduction in IQ associated with fluoride exposure is severe enough in some children to
2 produce mental retardation, the impact of which is obvious and catastrophic. However, even the loss of a
3 single IQ point is associated with significant economic loss. As calculated by Spadaro et al., a loss of a
4 single IQ point causes an average drop in lifetime earnings of \$18,000 in 2005 U.S. dollars, which, when
5 adjusted for inflation, amounts to \$22,250 in current dollars.

6 90. Since 200 million Americans now live in areas where water is fluoridated, and since virtually all
7 Americans consume processed foods and beverages made with fluoridated water, even a small reduction
8 in IQ from fluoridated water stands to have immense economic consequences.
9

10 11 **E. Recent Studies Show that Fluoridation Presents Little Meaningful Benefit to Teeth**

12 91. Fluoridation chemicals are the only chemicals added to municipal water that don't treat the water
13 itself. The sole purpose of adding fluoridation chemicals to water for use as a drug to reduce tooth decay,
14 a non-waterborne disease. Current research, however, demonstrates that the purported dental benefits
15 from fluoridation are much smaller than previously believed, with many studies failing to find any
16 measurable, clinically significant difference in tooth decay between fluoridated and non-fluoridated
17 areas.
18

19 92. There are no randomized controlled trials on the effectiveness of fluoridation, and few of the
20 available studies adequately account for potential confounders like socioeconomic status, sealants, and
21 dietary habits. The evidence has thus been characterized by the Cochrane Collaboration as having "high
22 risk of bias" and limited applicability to modern lifestyles.
23

24 93. Notwithstanding these methodological limitations, modern studies of fluoridation and tooth decay
25 have found that the difference in cavity rates between fluoridated and non-fluoridated areas is small,
26 inconsistent, and often non-existent, particularly in the permanent teeth.
27
28

1 94. Because of the meager differences in cavities now seen between fluoridated and non-fluoridated
2 areas, sensitive measurements of tooth decay must be utilized in order to detect *any* differences in decay.
3 But, even when sensitive measurements are utilized, the differences remain small in absolute terms,
4 inconsistent, and greatly overshadowed by the influence of other factors known to affect decay.

5 95. Studies from Canada, Cuba, Finland, Germany, and the United States did not detect *any*
6 measurable increase in decay following the termination of water fluoridation programs.
7

8
9 **F. Fluoridation Is Unnecessary as There Are Safer, More Effective Alternatives, Including**
10 **Topical Fluoride Products**

11 96. The addition of fluoridation chemicals to drinking water began in the U.S. prior to the advent of
12 topical fluoride products in an era when public health authorities believed fluoride's predominant benefit
13 to teeth comes from *ingestion*. Things have changed dramatically since that time.

14 97. Today, over 95% of toothpastes contain fluoride, as do many other dental products, and dental
15 researchers now universally acknowledge that fluoride's predominant benefit is topical, not systemic. As
16 explained in the *Journal of the American Dental Association*, "fluoride incorporated during tooth
17 development is insufficient to play a significant role in cavity protection." (Featherstone 2000) The
18 Centers for Disease Control has confirmed the primacy of fluoride's topical mechanisms, declaring that
19 "fluoride's predominant effect is *posteruptive* and *topical*." (CDC 2001) The NRC has confirmed this as
20 well, stating that "the major anticaries benefit of fluoride is *topical* and *not systemic*." (NRC 2006)
21

22 98. Since fluoride's primary benefit comes from topical contact with the teeth, there is little benefit
23 from swallowing fluoride, in water or any other product. In fact, a recent NIH-funded prospective study
24 of the relationship between tooth decay and total daily fluoride ingestion failed to find a detectable
25 relationship between the two. (Levy et al. 2009). Other recent studies investigating the relationship
26
27
28

1 between tooth decay and individual biomarkers of fluoride intake (e.g., toenail fluoride content and
2 dental fluorosis) have reported similar results.

3 99. The widespread availability of topical fluoride products highlights the lack of necessity of adding
4 fluoridation chemicals to water, particularly since the quality of evidence for fluoride toothpastes has
5 been recognized as vastly superior to the quality of evidence for water fluoridation. Furthermore, it is
6 well established that western countries that do not fluoridate their water have tooth decay rates that are
7 just as low, and often lower, as western countries that do fluoridate their water.

8 100. While fluoride toothpastes and other fluoridated dental products carry their own potential hazards
9 *when ingested*, these products—unlike drinking water—are not *designed* to be ingested. Further, unlike
10 the addition of fluoridation chemicals to drinking water, the use of topical fluoride products does not
11 result in the contamination of processed foods and beverages, thus making it easier to regulate the
12 amount of fluoride ingested when topical fluoride products are the vehicle for delivering fluoride to those
13 who want it.
14

15 VI. CAUSE OF ACTION

16
17 101. TSCA provides that a party that petitions EPA under 15 U.S.C. § 2620 is entitled to a *de novo*
18 review by a federal district court if EPA denies the petition.

19
20 102. If the petitioner demonstrates to the court by a preponderance of evidence that “the chemical
21 substance or mixture to be subject to the proposed rule presents an unreasonable risk of injury to health
22 or the environment, without consideration of costs or other nonrisk factors, including an unreasonable
23 risk to a potentially exposed or susceptible subpopulation, under the conditions of use,” there is
24 reasonable, “the court shall order the Administrator to initiate the action requested by the petitioner.” 15
25 U.S.C. § 2620(4)(B).

26
27 105. On November 22, 2016, Plaintiffs submitted a Petition to EPA, supported by over 300 attached
28 studies, documenting each of the allegations contained in Paragraphs 2 to 23 and 50 to 100 above.

1 106. EPA denied Plaintiff's Petition on February 17, 2017 based on a legally erroneous, factually
2 incorrect, and scientifically flawed assessment, wherein, *inter alia*, the EPA (A) erroneously interpreted
3 the Frank R. Lautenberg Chemical Safety for the 21st Century Act as placing onerous new evidentiary
4 burdens on citizen petitioners, (B) dismissed studies relied upon by Plaintiffs on demonstrably false
5 grounds, and (C) failed to consider the research on fluoride neurotoxicity through the framework of its
6 *Guidelines on Neurotoxicity Risk Assessment*.

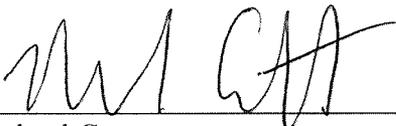
7 107. Plaintiffs are therefore entitled to a *de novo* judicial review of the Petition.
8
9

10 **VII. PRAYER FOR RELIEF**

11 108. WHEREFORE, Plaintiffs respectfully request that the Court grant the following relief;

- 12 a. Declare that Plaintiffs have demonstrated by a preponderance of the evidence that
13 artificial fluoridation of drinking water supplies presents an unreasonable risk of injury to
14 health or the environment, without consideration of costs or other nonrisk factors,
15 including an unreasonable risk to a potentially exposed or susceptible subpopulation,
16 pursuant to 15 U.S.C. § 2620(b)(4)(B)(ii).
17
18 b. Order EPA to initiate the action requested by Plaintiffs in their petition pursuant to 15
19 U.S.C. § 2620(b)(4)(B).
20
21 c. Award Plaintiffs their costs of suit and reasonable fees for attorneys and expert witnesses
22 in this action pursuant to 15 U.S.C. § 2620(b)(4)(C).
23
24 d. Grant Plaintiffs such further and additional relief as the Court may deem just and proper.

25 Respectfully submitted this 18th day of April, 2017.

26
27 By: 

Michael Connett
Attorney for Plaintiffs

JS-CAND 44 (Rev. 07/16)

CIVIL COVER SHEET

The JS-CAND 44 civil cover sheet and the information contained herein neither replace nor supplement the filing and service of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved in its original form by the Judicial Conference of the United States in September 1974, is required for the Clerk of Court to initiate the civil docket sheet. (SEE INSTRUCTIONS ON NEXT PAGE OF THIS FORM.)

I. (a) PLAINTIFFS

Food + Water Watch, American Academy of Environmental Medicine, Florida Action Network, International Academy of Oral Medicine & Toxicology, Mans Against Fluoridation, Audrey Adams, Kyle Adams, Krishna Lavelle, Neal Lavelle, Brenda Staudenmaier, Ko Staudenmaier, Hayden Staudenmaier

(b) County of Residence of First Listed Plaintiff **Alameda**
(EXCEPT IN U.S. PLAINTIFF CASES)

(c) Attorneys (Firm Name, Address, and Telephone Number)

Michael Connett
c/o Food + Water Watch
1814 Franklin St, Suite 1100
Oakland CA 94612
Tel: 510-922-0720

DEFENDANTS

- Environmental Protection Agency
- Scott Pruitt (Administrator of EPA)

County of Residence of First Listed Defendant **District of Columbia**
(IN U.S. PLAINTIFF CASES ONLY)

NOTE: IN LAND CONDEMNATION CASES, USE THE LOCATION OF THE TRACT OF LAND INVOLVED.
Attorneys (If Known)

II. BASIS OF JURISDICTION (Place an "X" in One Box Only)

- 1 U.S. Government Plaintiff
- 2 U.S. Government Defendant
- 3 Federal Question (U.S. Government Not a Party)
- 4 Diversity (Indicate Citizenship of Parties in Item III)

III. CITIZENSHIP OF PRINCIPAL PARTIES (Place an "X" in One Box for Plaintiff and One Box for Defendant)

	PTF	DEF		PTF	DEF
Citizen of This State	<input type="checkbox"/> 1	<input type="checkbox"/> 1	Incorporated or Principal Place of Business In This State	<input type="checkbox"/> 4	<input type="checkbox"/> 4
Citizen of Another State	<input type="checkbox"/> 2	<input type="checkbox"/> 2	Incorporated and Principal Place of Business In Another State	<input type="checkbox"/> 5	<input type="checkbox"/> 5
Citizen or Subject of a Foreign Country	<input type="checkbox"/> 3	<input type="checkbox"/> 3	Foreign Nation	<input type="checkbox"/> 6	<input type="checkbox"/> 6

IV. NATURE OF SUIT (Place an "X" in One Box Only)

CONTRACT	TORTS	FORFEITURE/PENALTY	BANKRUPTCY	OTHER STATUTES	
<input type="checkbox"/> 110 Insurance <input type="checkbox"/> 120 Marine <input type="checkbox"/> 130 Miller Act <input type="checkbox"/> 140 Negotiable Instrument <input type="checkbox"/> 150 Recovery of Overpayment of Veteran's Benefits <input type="checkbox"/> 151 Medicare Act <input type="checkbox"/> 152 Recovery of Defaulted Student Loans (Excludes Veterans) <input type="checkbox"/> 153 Recovery of Overpayment of Veteran's Benefits <input type="checkbox"/> 160 Stockholders' Suits <input type="checkbox"/> 190 Other Contract <input type="checkbox"/> 195 Contract Product Liability <input type="checkbox"/> 196 Franchise	PERSONAL INJURY <input type="checkbox"/> 310 Airplane <input type="checkbox"/> 315 Airplane Product Liability <input type="checkbox"/> 320 Assault, Libel & Slander <input type="checkbox"/> 330 Federal Employers' Liability <input type="checkbox"/> 340 Marine <input type="checkbox"/> 345 Marine Product Liability <input type="checkbox"/> 350 Motor Vehicle <input type="checkbox"/> 355 Motor Vehicle Product Liability <input type="checkbox"/> 360 Other Personal Injury <input type="checkbox"/> 362 Personal Injury - Medical Malpractice	<input type="checkbox"/> 365 Personal Injury - Product Liability <input type="checkbox"/> 367 Health Care/ Pharmaceutical Personal Injury Product Liability <input type="checkbox"/> 368 Asbestos Personal Injury Product Liability PERSONAL PROPERTY <input type="checkbox"/> 370 Other Fraud <input type="checkbox"/> 371 Truth in Lending <input type="checkbox"/> 380 Other Personal Property Damage <input type="checkbox"/> 385 Property Damage Product Liability	<input type="checkbox"/> 625 Drug Related Seizure of Property 21 USC § 881 <input type="checkbox"/> 690 Other LABOR <input type="checkbox"/> 710 Fair Labor Standards Act <input type="checkbox"/> 720 Labor/Management Relations <input type="checkbox"/> 740 Railway Labor Act <input type="checkbox"/> 751 Family and Medical Leave Act <input type="checkbox"/> 790 Other Labor Litigation <input type="checkbox"/> 791 Employee Retirement Income Security Act IMMIGRATION <input type="checkbox"/> 462 Naturalization Application <input type="checkbox"/> 465 Other Immigration Actions	<input type="checkbox"/> 422 Appeal 28 USC § 158 <input type="checkbox"/> 423 Withdrawal 28 USC § 157 PROPERTY RIGHTS <input type="checkbox"/> 820 Copyrights <input type="checkbox"/> 830 Patent <input type="checkbox"/> 840 Trademark SOCIAL SECURITY <input type="checkbox"/> 861 HIA (1395ff) <input type="checkbox"/> 862 Black Lung (923) <input type="checkbox"/> 863 DIWC/DIWW (405(g)) <input type="checkbox"/> 864 SSID Title XVI <input type="checkbox"/> 865 RSI (405(g)) FEDERAL TAX SUITS <input type="checkbox"/> 870 Taxes (U.S. Plaintiff or Defendant) <input type="checkbox"/> 871 IRS-Third Party 26 USC § 7609	<input type="checkbox"/> 375 False Claims Act <input type="checkbox"/> 376 Qui Tam (31 USC § 3729(a)) <input type="checkbox"/> 400 State Reapportionment <input type="checkbox"/> 410 Antitrust <input type="checkbox"/> 430 Banks and Banking <input type="checkbox"/> 450 Commerce <input type="checkbox"/> 460 Deportation <input type="checkbox"/> 470 Racketeer Influenced and Corrupt Organizations <input type="checkbox"/> 480 Consumer Credit <input type="checkbox"/> 490 Cable/Sat TV <input type="checkbox"/> 850 Securities/Commodities/Exchange <input type="checkbox"/> 890 Other Statutory Actions <input type="checkbox"/> 891 Agricultural Acts <input type="checkbox"/> 893 Environmental Matters <input type="checkbox"/> 895 Freedom of Information Act <input type="checkbox"/> 896 Arbitration <input checked="" type="checkbox"/> 899 Administrative Procedure Act/Review or Appeal of Agency Decision <input type="checkbox"/> 950 Constitutionality of State Statutes

V. ORIGIN (Place an "X" in One Box Only)

- 1 Original Proceeding
- 2 Removed from State Court
- 3 Remanded from Appellate Court
- 4 Reinstated or Reopened
- 5 Transferred from Another District (specify)
- 6 Multidistrict Litigation-Transfer
- 8 Multidistrict Litigation-Direct File

VI. CAUSE OF ACTION

Cite the U.S. Civil Statute under which you are filing (Do not cite jurisdictional statutes unless diversity): **15 USC 2620**
 Brief description of cause: **De Novo Review of Agency Action/Inaction**

VII. REQUESTED IN COMPLAINT:

CHECK IF THIS IS A CLASS ACTION UNDER RULE 23, Fed. R. Civ. P. DEMANDS CHECK YES only if demanded in complaint:
 JURY DEMAND: Yes No

VIII. RELATED CASE(S), IF ANY (See instructions):

JUDGE DOCKET NUMBER

IX. DIVISIONAL ASSIGNMENT (Civil Local Rule 3-2)

(Place an "X" in One Box Only) SAN FRANCISCO/OAKLAND SAN JOSE EUREKA-MCKINLEYVILLE

DATE: **April 18, 2017**

SIGNATURE OF ATTORNEY OF RECORD: *[Signature]*



LEAGUE *of* UNITED LATIN
AMERICAN CITIZENS

Civil Rights Violation Regarding Forced Medication

WHEREAS, the League of United Latin American Citizens is this nation's oldest and largest Latino organization, founded in Corpus Christi, Texas on February 17, 1929; and

WHEREAS, LULAC throughout its history has committed itself to the principles that Latinos have equal access to opportunities in employment, education, housing and healthcare; and

WHEREAS, LULAC advocates for the well-being of, but not exclusively of, Hispanics throughout our country; and

WHEREAS, safe drinking water is a necessity for life; and

WHEREAS, the purpose of a public water supply is to supply water to the entire community which is composed of people with varying health conditions, in varying stages of life, and of varying economic status; not to forcibly mass medicate the population which is a civil rights violation; and

WHEREAS, fluoridation is mass medication of the public through the public water supply; and

WHEREAS, current science shows that fluoridation chemicals pose increased risk to sensitive subpopulations, including infants, the elderly, diabetics, kidney patients, and people with poor nutritional status; and

WHEREAS, minority communities are more highly impacted by fluorides as they historically experience more diabetes and kidney disease; and

WHEREAS, minorities are disproportionately harmed by fluorides as documented by increased rates of dental fluorosis (disfiguration and discoloration of the teeth); and

WHEREAS, the National Research Council in 2006 established that there are large gaps in the research on fluoride's effects on the whole body; a fact that contradicts previous assurances made by public health officials and by elected officials, that fluorides and fluoridation have been exhaustively researched; and

WHEREAS, a growing number of cities and health professionals have rejected fluoridation based on current science and the recognition of a person's right to choose what goes into his/her body; and

WHEREAS, the CDC now recommends that non-fluoridated water be used for infant formula (if parents want to avoid dental fluorosis – a permanent mottling and staining of teeth), which creates an economic hardship for large numbers of families, minority and otherwise; and

WHEREAS, the League of United Latin American Citizens (LULAC), founded in 1929, has historically been a champion of the disenfranchised and a leader in the fight for social and environmental justice; and

WHEREAS, City Council Districts I-6 of San Antonio (predominantly minority districts) voted overwhelmingly that the public water supply should not be contaminated with fluoridation chemicals; and

WHEREAS, the election to fluoridate the water, essentially disenfranchised the right of these minority Districts to safe drinking water for all; and

WHEREAS, the U.S. Health and Human Services and the EPA (January 2011) have recently affirmed the NRC Study results that citizens may be ingesting too much fluoride and that the exposure is primarily from drinking water; and

WHEREAS, the proponents of fluoridation promised a safe and effective dental health additive, but the San Antonio Water System's (SAWS) contract for fluoridation chemicals proves a "bait and switch"; as SAWS is adding the toxic waste by-product of the phosphate fertilizer industry, that has no warranty for its safety and effectiveness for any purpose from the supplier (PENCCO, Inc.) or the source (Mosaic Chemical); and

THEREFORE, BE IT RESOLVED, that LULAC commends efforts by organizations that oppose forced mass medication of the public drinking supplies using fluorides that are industrial grade, toxic waste by-products which contain contaminants (arsenic, lead, mercury) which further endanger life; and

BE IT FURTHER RESOLVED, that LULAC supports efforts by all citizens working to stop forced medication through the public water system because it violates civil rights; and

BE IT FURTHER RESOLVED, that LULAC opposes the public policy of fluoridation because it fails to meet legislative intent; and

BE IT FURTHER RESOLVED, that LULAC demands to know why government agencies entrusted with protecting the public health are more protective of the policy of fluoridation than they are of public health.

Approved this 1st day of July 2011.

Margaret Moran
LULAC National President

Full Name (First and Last): Joseph Wasserman

Name of Organization or Community: Hartford Coalition for Safe Technology

City and State: West Hartford, CT

Brief description about the concern: I am submitting these comments as an individual supporter of the Hartford Coalition for Safe Technology and they are in addition to the organization's statement that is being sent to you separately. I am concerned about the health impact of 5G antennas being placed all over Hartford, throughout low income, African American and Latino communities. These 5G antennas have been placed near homes with little if any input from neighborhoods residents. Tenants are not even being notified of their placement. 5G is the next generation of wireless technology. It uses new types of radio frequency microwave radiation to transmit large amounts of data. The installation of 5G antennas, so close to homes means prolonged exposure to these radio frequency waves by Hartford residents. Families and children will be impacted by this prolonged exposure. I am not opposed to developing this technology, I just want to make sure it is delivered in a safe way. I fear the 5G antennas are not safe, due to the radio frequency waves being emitted, on a constant basis. Study after study has linked radio frequency waves exposure to health impacts. A 2011 World Health Organization study pointed to radio frequency radiation as a 2B possible Carcinogen. A 30 million dollar 2018 National Institute of Health (NIH) taxpayer funded study pointed to a clear link between cancer and cell phone radiation in animals. A 2018 study by the Ramazzini Institute found the same tumors as the NIH study. Dr. Hugh Taylor's Yale Team found that mice who had been exposed to cell phone radiation had offspring with poorer memory, hyperactivity- signs of ADHD. These are only a few of the many studies linking exposure to radio frequency radiation to health impacts. Perhaps these studies led major insurance companies such as Lloyd's of London to make the decision not to insure 5G technology. What does Lloyd's of London know that the public should be aware of?

What do you want the WHEJAC to advise the White House Council on Environmental Quality to do?:

The White House Environmental Justice environmental Committee should advocate for Updating the FCC safety standards for radio frequency emissions to take into recent scientific findings. These standards have not been updated since the 1990s. Continuous monitoring of 5G antennas. A halt in the construction of 5G antennas until we have more information on the health and environmental impact of 5G antennas. Utilizing existing fiber optic infrastructure as an alternative to 5G antennas.

Full Name (First and Last): Julie Seitz

Name of Organization or Community: Grassroots community coalition, "K-9s, Pets and People Over Profit"

City and State: Federal Way, WA

Brief description about the concern: We are experiencing environmental and economic injustices at the hands of government we had faith in to protect us and our sacred burial grounds from harm. Please see additional material by way of email to whejac@epa.gov: "08.18.2022 Letter to United States White House Environmental Justice Interagency Council by Seitz, Bey et al."

What do you want the WHEJAC to advise the White House Council on Environmental Quality to do?:

We respectfully request that the issue of cell tower placement be included on the Environmental Justice Scorecard that the federal government is preparing. Thank you.

Dear Honorable Members of the White House Environmental Justice Interagency Council,

This email serves as additional material to our online submission earlier today at <https://www.epa.gov/environmentaljustice/forms/white-house-environmental-justice-advisory-council-whejac-public-comment>.

Please see attached letter:

08.18.2022 Letter to United States White House Environmental Justice Interagency Council by Seitz, Bey et al.

Thank you.

Respectfully Submitted,

Seitz, Bey, et al.

August 18, 2022

White House Environmental Justice Interagency Council
United States Environmental Protection Agency (EPA)
1200 Pennsylvania Avenue, N.W.
Washington, DC 20460
whejac@epa.gov

SENT VIA ELECTRONIC MAIL

Dear Honorable Members of the *White House Environmental Justice Interagency Council*,

RE: “Environmental Justice Scorecard” and cell tower placement, bringing awareness to our experience

Our community was invited by Dr. Theodora Scarato, Executive Director of *Environmental Health Trust* (EHT), to provide public comments to the “White House Environmental Justice Interagency Council” and ask that the issue of cell tower placement be included on the Environmental Justice Scorecard that the federal government is preparing.

We respectfully request that the issue of cell tower placement be included on the Environmental Justice Scorecard that the federal government is preparing.

We are 29 people of over 100+ people and counting who represent a multi diverse community of cemetery patrons, residents bordering a cemetery, community members, and interested parties adversely impacted by one 100-foot cell tower permitted during COVID-19 (2020) inside an active burial block with graves and mourners at the 2-acre historic *Seattle-Tacoma Pet Cemetery* est. 1950, in unincorporated South King County (Kent, WA), breaking WA State cemetery laws and violating King County Code (KCC). Humans, pets, K-9 Officers, and service animals for the blind are interred here in a continuously run, active historic cemetery, the county’s primary burial place for companion animals for 72 years and its role in the social rituals of the community. This is a human cemetery as defined by state cemetery law with state law protections. The historic *Seattle-Tacoma Pet Cemetery* is a King County Community Landmark, is officially eligible for King County Landmark designation, and is officially eligible for entries in the *Washington State Heritage Register* and the *National Register of Historic Places* (NRHP).

King County Department of Permitting and Environmental Review (KC DPER) violated their own KCC by permitting this 100-foot cell tower in our 2-acre historic cemetery dedicated for cemetery use, by permitting in the wrong zone of Industrial with a P suffix “I-P” (not the zone of the cemetery, which is Neighborhood Business “NB”, a cemetery cannot be zoned I-P), and by permitting without requiring the correct Conditional Use Permit (CUP). KCC only allows for a 60-foot cell tower in a NB zone without a CUP. Our local county government even pushed this cell

Letter to the *United States White House Environmental Justice Interagency Council*, August 18, 2022 1

tower through as an accessory use to a cemetery which violates WA State cemetery law and KCC. The WA State *Department of Archeology & Historic Preservation* (DAHP) requested the re-opening of both the state and federal environmental processes, i.e., the SEPA and Section 106, based on the non-disclosure of human remains and the non-disclosure of the historic and cultural significance of the cemetery property on the applications, but were denied by the county and federal governments. Both the federal and county governments said their hands were tied.

King County pointed the marginalized and disenfranchised residents to *King County Superior Court* on this incorrect permit which created an insurmountable barrier for our community of color, immigrants, refugees, and low-income households (including Section 8 housing). The correct permit, a Conditional Use Permit (CUP) would have been appealable to the *King County Hearing Examiner*, much less of a barrier. Marginalized and disenfranchised cemetery patrons were not notified as they are not required to be notified according to KCC. Despite our attempts with King County to get KCC changed to notify cemetery patrons of proposed land use actions, we have had no success to date. Not a priority.

The 100-foot cell tower is TOO HIGH, TOO CLOSE to cemetery patrons practicing their religious freedom and rites with their deceased beloveds laid to rest in marked and unmarked graves both inside and outside of burial blocks, to residents bordering the cemetery and adjacent to the cell tower who live here and expect quiet enjoyment, and visitors who come to the cemetery and cemetery neighborhood at least expecting PUBLIC SAFETY. We all are expecting at the very least PUBLIC SAFETY. Safety from harm to our physical and mental health.

Imagine sharing Burial Block 13 with your beloved mother's grave and a 100-foot cell tower literally looming overhead complete with penitentiary-style razor wire and a posted *Federal Communications Commission* (FCC) radio frequency radiation emissions warning sign. Imagine the 100-foot cell tower with the potential of four multibillion-dollar international telecom corporations (one tower builder, three cell carriers) doing business literally right next to you while you grieve and memorialize your deceased beloveds or while you live less than 155 feet away. How do you feel when you hear a case of regulatory neglect that matters here? On August 13, 2021 the U.S. Court of Appeals for the D.C. Circuit ruled the FCC ignored scientific evidence and failed to provide a reasoned explanation for its determination that its 1996 regulations adequately protect the public against all the harmful effects of wireless radiation. *EHT et al. v. FCC 2021*.

We are not anti-technology, but for safe technology and the appropriate placement of cell towers. No cell towers in cemeteries where our ancestors and our beloved companion and service animals lay, and where people practice their religious freedom and rites. This is the United States of America. This is common sense. No cell towers TOO HIGH, TOO CLOSE that would land, if they fell over (which literally does happen) in people's yards or hit their houses. God forbid injure or kill a person or animal. Cell tower placement needs careful consideration to ensure environmental justice and not the opposite.

King County has admitted to mistakes, yet we see they are not assigning any penalties to themselves. Sadly, King County to date has not remedied the egregious environment and economic injustices that is harming our community and is not attending to the ultimate PUBLIC SAFETY issue they have created. King County is not interested in making things right with a community of color, immigrants, refugees, and low-income households (including Section 8 housing). How do we know this? We have collectively fought this cell tower placement from the beginning since February 1, 2019 (over 3-1/2 years). Our local county government has not gotten back to us with any remedy. We ask King County not to issue any further permits on this tower. They proceed. We ask them to rescind the tower permit and pay the damages. We wait. They can certainly do this. In fact, this 100-foot tower here was a result of a new plan when a tri-county project (involving King County), "Sound Transit", took over a cell tower by eminent domain less than a ½ mile away. Our local county government demonstrates that they do what they want.

We think that by including the issue of cell tower placement on the Environmental Justice Scorecard that the federal government is preparing will help bring awareness to our experience and situation and the situation at large. Certainly, this could help others and our community too by way of supports.

Thank you for hearing our request and the environmental and economic injustices we are experiencing at the hands of government we had faith in to protect us and our sacred burial grounds from harm.

Respectfully Submitted,

Points of Contact

Julie Seitz, Federal Way, WA, email julieseitz.js@gmail.com
:Dean-Ali-Blackwell: Bey, North Bend, WA, email deanb999@gmail.com

Signed electronically

1. Julie Seitz, Federal Way, WA
2. :Dean-Ali-Blackwell: Bey, North Bend, WA
3. Lisa Jilek, Port Orchard, WA
4. Victoria Shilley, University Place, WA
5. Lloyd Guthrie, Olympia, WA
6. Lanell Washington, Kent, WA
7. Lee Lundquist, Kent, WA
8. Darrell Herzog, Kent, WA
9. Blanca Raymundo, Kent, WA
10. Shukri Olow, Kent, WA
11. Barbara McMichael, Des Moines, WA
12. Anne Bosse, Kent, WA

13. Dennis Jaraczski, Kent, WA
14. Phylliss Lundquist, Kent, WA
15. Dana Yang, Bellevue, WA
16. Robert Guadiz, Kent, WA
17. Joan Hall, Greensburg, IN
18. Rachael McAlister, Auburn, WA
19. Rachel Wright, Redmond, WA
20. Joni Dennison, Federal Way, WA
21. Suzanne Vargo, Federal Way, WA
22. Anita Petter, Kent, WA
23. Kathy Sura, Kent, WA
24. Trish Foss, SeaTac, WA
25. Ken Jacobsen, Seattle, WA
26. Cicely Wylde, Burien, WA
27. Dr. Jason Goodwin, Tukwila, WA
28. Laura Sullivan, Jefferson, ME
29. Amit Sharma, Gig Harbor, WA

CC:

- U.S. Rep. Adam Smith (WA State, D-09)
- U.S. Sen. Patty Murray (WA State)
- U.S. Sen. Maria Cantwell (WA State)
- WA State Rep. Tina Orwall (D-33)
- WA State Rep. Mia Gregerson (D-33)
- WA State Sen. Karen Keiser (D-33)
- WA State Rep. Jamila Taylor (D-30)
- WA State Sen. Rebecca Saldaña (D-37)
- WA State *Department of Archeology & Historic Preservation* (DAHP) Executive Director and State Historic Preservation Officer (SHPO) Dr. Allyson Brooks
- WA State DAHP State Physical Anthropologist Dr. Guy Tasa
- WA State Assistant Attorney General Sandra Adix
- King County Executive Dow Constantine
- King County Deputy Executive April Putney
- King County Executive Office Chief of Staff Shannon Braddock
- King County Councilmember Dave Upthegrove (District 5)
- King County Prosecuting Attorney's Office (PAO) Supervising Attorney Darren Carnell
- King County *Local Services* Director John Taylor
- King County *Department of Permitting and Environmental Review* (KC DPER) Director Jim Chan
- King County *Department of Permitting and Environmental Review* (KC DPER) Commercial Product Line Manager Ty Peterson
- King County *Office of the Ombuds* Director Amy Calderwood

- King County *Office of the Ombuds* Senior Deputy Ombuds for Rural and Unincorporated Area Affairs Elizabeth Hill
- Greater Kent Historical Society and Museum President Eileen Lamphere
- *Washington Trust for Historic Preservation* Executive Director Chris Moore
- *Environmental Health Trust* (EHT) Executive Director Dr. Theodora Scarato
- David Bricklin, Land Use and Environmental Attorney, *Bricklin & Newman, LLP*

My name is Maria Santiago Valentin and I am a resident of New Jersey. I am one of the CoFounders of the Atlantic Climate Justice Alliance. A baseline needs to be developed to measure progress. The baseline could be the current practices and evidence federal agencies have to address environmental justice. The performance scorecard to evaluate the efficacy and effectiveness of the federal government should include a checklist with the indicators and a rubric that describes the level of effectiveness and efficacy to meet the target goals that address the needs of overburdened communities. The scorecard should include a section with recommendations to improve poor scores. It should be determined by WHEJAC the stakeholders who will submit their evaluations. The scorecard should include the following indicators:

1. Financial perspectives including equity in funds disbursement to organizations and/ or developers whose leaders are BIPOC, whose sites are located in and work in underrepresented communities
2. Communication to all stakeholders, their genuine efforts to eliminate accessibility barriers to access information in variety of forms and languages,
3. Their learning goals and evidence of a learning curve in the way systemic racism is addressed.
4. Efforts and evidence of effective diversity and inclusion measures, policies, and best practices.
5. Evidence and efforts of increasing representation of underrepresented groups in staff and positions that lead to decision making in the federal agencies.
6. Evidence of more than 40% diverse leadership representation in the federal agencies
7. Creation of a scorecard, materials and resources to engage the participation of individuals who speak other languages and who has special needs (audio, Braille, text to speech features)
8. The stakeholders who will score the federal agencies should include the representation of the members of the community that live with environmental racism day in and day out: leaders, business owners, students, community organizers, etc.
9. Annual public reports with the results of the evaluation that show areas of strengths, weaknesses and areas in need of improvement/ opportunities for growth.
10. Professional development to staff on topics related to environmental justice.
11. Data collection and analysis through triangulation methods if it is qualitative to minimize the risk of biases in reports, interpretation of data and recommendations

Example of a scorecard with some of the indicators I mentioned before.

CATEGORY	4	3	2	1
Professional Development	The indicator has been created, implemented with clear timelines, and monthly meetings to monitor progress.	The indicator has been developed but not implemented in the agency.	In the process of developing the indicator.	No Plan in Place

Financial Practices- Equity	The indicator has been created, implemented with clear timelines, and monthly meetings to monitor progress.	The indicator has been developed but not implemented in the agency.	In the process of developing the indicator.	No Plan in Place
Diverse and Inclusion in Hiring Practices	The indicator has been created, implemented with clear timelines, and monthly meetings to monitor progress.	The indicator has been developed but not implemented in the agency.	In the process of developing the indicator.	No Plan in Place
Underepresented Communities as Evaluators	The indicator has been created, implemented with clear timelines, and monthly meetings to monitor progress.	The indicator has been developed but not implemented in the agency.	In the process of developing the indicator.	No Plan in Place
Diverse Leadership	The indicator has been created, implemented with clear timelines, and monthly meetings to monitor progress.	The indicator has been developed but not implemented in the agency.	In the process of developing the indicator.	No Plan in Place
Data Collection and Analysis	The indicator has been created, implemented with clear timelines, and monthly meetings to monitor progress.	The indicator has been developed but not implemented in the agency.	In the process of developing the indicator.	No Plan in Place
Removal of Accessibility Barriers to access information	The indicator has been created, implemented with clear timelines, and monthly meetings to monitor progress.	The indicator has been developed but not implemented in the agency.	In the process of developing the indicator.	No Plan in Place
Communication Practices with underrepresented communities	The indicator has been created, implemented with clear timelines, and monthly meetings to monitor	The indicator has been developed but not implemented in the agency.	In the process of developing the indicator.	No Plan in Place

	progress.			
Accessible Annual Public reports	The indicator has been created, implemented with clear timelines, and monthly meetings to monitor progress.	The indicator has been developed but not implemented in the agency.	In the process of developing the indicator.	No Plan in Place

I am contacting you on behalf of the City of Saint Paul Island, AK.

Saint Paul is a mostly Unangan/Aleut Native community located in the central Bering Sea. Its economy and social-cultural well-being is dependent on the surrounding fishery and marine mammal resources. The fisheries the community depends on – crab and halibut -- have been impacted in recent years by dramatic declines resulting most likely in part from climate change. However, issues involving the equitable use of the sea's limited resources, as well as the sharing in the burdens of conservation as they relate to fish bycatch reductions, have figured prominently.

The community mostly interacts on these matters with the National Marine Fisheries Service, although EPA and White CEQ guidance have played a role in recent fisheries management decisions disproportionately affecting Saint Paul and other Alaska Native communities.

Is the meeting announced for August 3rd and the comments you are seeking, specific to EPA issues and policies regarding environmental justice or does it apply to other agencies, such as NMFS, as well?

Sincerely,

Mateo Paz-Soldan

On behalf of the City of Saint Paul Island, AK

Full Name (First and Last): Matt Holmes

Name of Organization or Community: Little Manila Rising

City and State: Stockton

Brief description about the concern: Unable to attend in person. Excited to see the potential for an environmental justice scorecard. I think it is important that we finally settle on some metrics for evaluation as to how agencies engage with and impact communities. 1st is the "engagement framework" I'm concerned that different agencies will either "call it in" or show "real hustle" and give communities whiplash. Let's establish how Gov't agencies cede power to these impacted communities that they have categorically failed to provide equal protection to. Early conversations, consistent noticing/ consistent steering & advisory dynamics / consistent budgetary design & oversight.

2nd I'm worried about agencies designing their own scorecard criteria. Always worried about anyone grading their own test or painting business as usual with broad "EJ" strokes (ie a proj exists in theory near licoc... therefore it's an ej project.) Remember we have to do this because trust has been destroyed BY THESE AGENCIESnow we're supposed to let them package their review? Nope. They earn trust back by losing power to the people they injured... and these are injuries like advanced mortality rates. Totally cool to work for an agency and break with that history... totally unacceptable to conflate current personnel with agency history and protect the agency cause current personnel have "feelings." Go scream in your pillow if you've got feelings... We've been carrying coffins and it's time for truth and reconciliation.

3rd I'm worried you all don't have the power to implement any of this or the political will to show up when our rotten local governments don't want to play ball.

What do you want the WHEJAC to advise the White House Council on Environmental Quality to do?:

1st we need to formalize how we cede power to impacted communities or your score card is performance theater. Score card should reflect formal engagement criteria: Pay people to show up, pay people to gain the requisite literacy to make informed choices when they advise, pay them to advise,..... when they do advise provide written responses for inclusion or exclusion of the requested edits, and pay them to reasons to the response. We've got to stop cooking up recipies years in advance and then ask folks what we would do differently when it's already in the oven. Only engage if you're serious about ceding authorship. If you're not then stick with the D.A.D. principle and we'll just tie you up on court like it's 1974. But don't "engage us" just to "big league" us with your "technical expertise." That's the same technical expertise that left us with this broken country that's not ready for the challenge of our time. Track records should mean something and it's time for traditional institutions to let go of the power they have abused and misused for so long.

2nd Certainly there are agency idiosyncrasies that require nuanced descriptive scorecard criteria. However there should be a "top deck" layer of criteria that evaluates a) basic need of a project or campaign (according to who), b) interest from the impacted community (whose idea was this? Or are we getting sold on some business as usual Agenda for an agency in its comfort zone) a) & b) play together. An agency can describe need to me and it can be new to me and i can still support it. What matters is when we differ and the promised outcomes are in question. If all things are equal then the agency should side with the community. It's not like they can do any worse than the status quo and if we are prioritizing based on limited resources we should run with the communities priorities. If the community gets it wrong and the agency did everything it could to inform them and support them and it goes South for once or won't be the agency's fault and c) finally efficacy of the project or campaign: "where is the work"; "demonstrated literacy about the specific impacted communities"; "how Much Money is being

Spent in total" & "How much of that money OR benefit is directly experienced by impacted communities. " Beneath that we can get into agency specifics.

3rd and final recommendation.

Federal government seems to have all the political will it needs when it's time to deliver tanks and mrops to our community and back up local law enforcement but they don't seem to have any will to show up when a local rail Authority decides to only impact black communities. Feds will do nothing to offset the impacts to impacted communities even when the local authorities or it in writing that they don't have to mitigate "because the project's not disproportionately impacting black communities it's only impacting black communities!" That stuff happens right here in California. Federal dollars are spent on those projects and unless I have a lawyer to show up and threaten my local rail Commission on my County Planning Commission it gets Greased through. So there needs to be some sort of criteria on your scorecard about follow through and affirming that federal dollars that work with local agencies comport themselves to the expectations of this environmental justice scorecard. I can't tell you how many decent ideas have turned terrible in local hands. I'll just say Homestead Act (whites only) fair housing act (redlining), GI Bill (whites only) & and the transportable bills that creamed freeways through poor people's neighborhoods pretty much everywhere. DC's about to spend a ton of money all over this country and there's plenty of terrible people that want to use it to hurt already vulnerable people. I hope you see the potential of this scorecard to rectify much of what is wrong in this country. Thank you for the opportunity to comment.

I did listen to both meetings held this week and am very impressed by all participants. All concerns made public were horrific because they are all true. I wish to comment that the FAA was not mentioned in the conversations . Piston-engine planes use enough leaded fuel to account for 1/2 of lead pollution in American skies. Repeated pollution from lead fuel causes severe damage to the human body. Auto lead gas was phased out over 25 years ago, yet the FAA has not addressed this concern. My home is 1 block from a GA airport . Reid Hill View airport continues to operate . The pilots association deny the EPA findings that found significant lead levels in the blood of the neighborhood children. The County of Santa Clara voted unanimously to close the airport, but the pilots are fighting this by sending letters to congress and other government officials. My neighborhood is comprised of people of color. This is another example of environmental racism. I am sure my home is not the only one in America that is being poisoned by GA airplanes. Most of the small airports are indeed located in areas where lower income people of color reside.

Please do include the FAA in your focus of agencies who must be held accountable to the polluting our air and poisoning our most vulnerable communities.

Regards

Rachel Grocha Welch

San Jose, CA.

God bless you!

Thank you for the work you are doing and for the opportunity of being part of the White House Environmental Justice Advisory Council Virtual Public Meeting in August 3, 2022. Here is my public commentary for your consideration. Blessings!

Rev. Dr. Sary N. Rosario-Ferreira,
Faith Committee El Puente
El Puente Enlace Latino de Acción Climática

Iglesia Cristiana (Discípulos de Cristo)
en Puerto Rico

Communities experiencing environmental injustices
by the New Fortress Energy LNG gas Facility and Pipeline in San Juan, Puerto Rico
August 2022

As communities near the port of San Juan we have been carrying the burden of many decades of air contamination because, of the fossil fuel plant of Puerto Rico Electric Power Authority (PREPA) in the Port of San Juan additional to other facilities located near it, that had affected the respiratory health of the communities.

In August 2019 we got acquainted of the construction of New Fortress Energy Liquefied Natural Gas facilities without important environmental assessment like Environmental impact statement and without the Federal Energy Regulatory Commission (FERC) permit. The community did not know about this project and the local government did not celebrate public hearings. We knew about this thanks to El Puente Enlace Latino de Acción Climática, an environmental organization, in a public hearing from the Coast Guard. All the communities that are near New Fortress facilities are low income and the majority of the population are elderly people who fought in many circumstances in the past because of the air contamination.

New Fortress energy represents three major concerns to the community. First the facility is 400 feet from Sabana community, and some scientific experts that oriented the community had told us that an accident with methane gas that can occur in the NLG tanker or in the process to give gas (methane gas pipeline) to the power plant, the explosion can affect until 2 miles of distance. In Sabana we have the Maritima Street with the Puma Energy Pipeline in the back yard of the houses increasing the unsecurity of the area. The communities near are: Sabana, Amelia, Vietnam, from Guaynabo, Puerto Nuevo Norte from San Juan, and Cataño town. Second, the methane gas production of electricity produces contaminants that affects the health of the people that are exposed to it. Third, the combustion of methane gas to produce electricity increase the contamination and increase the climate change in the world and in Puerto Rico.

Some of the churches and their pastors and a religious organization named “Hermandad Pastoral de Puerto Nuevo” sent a letter in March 2020 to FERC requesting a revision why New Fortress has not their permit and describing the security threats and the increase in contamination for the community. We sent another letter in June 2020 to follow up and other environmental organizations sent another letter. They answered one year later that New Fortress must ask FERC permit and regulations. The decision allowed New Fortress to continue operating because according to them it was for the public interest. New Fortress Energy appeal the decision of this federal commission to the court of District of Appeals in Washington DC.

The same year in 2020 the Sierra Club and El Puente helped the community in demanding the court in Puerto Rico, but the Court in San Juan and the Appeal court dismiss the case and did

not examine the information that the experts had in the case and the decision was taken because any explosion had occurred, and nobody had died or harm have been done. The community has no protection from the hazard that the New Fortress Operation represents. The municipalities of San Juan, Guaynabo and Cataño do not have an evacuation plan in case of an explosion by an accident with methane gas in San Juan Bay or in the facilities of New Fortress.

The claim produced an investigation in the legislature of Puerto Rico that begun in May 2021, but we are waiting one year for the New Fortress answers because the person that represented the company in the public hearings of Resolution of the Chamber 170 did not know how to answer the questions. The community was displaced in this process because when the ocular visit to the facilities of the company came, they did not allow the community to enter the facility with the legislators, only the legislators enter the facility. Now we are waiting a year after this, and we called them, and nothing has been done.

The community with the environmental organizations works with education efforts, ecumenical events for prayer and advocacy in the legislature. All these efforts had been in the pandemic time with many difficulties but with an inner sense of justice that moves us to stand against environmental injustices. Again in 2022 the pastors of the community wrote another letter to FERC this time because of the plan of the Us Corps of Engineers for dredging the San Juan Bay. One of the reasons of the dredging is the expansion of the canal for the entrance of bigger liquified natural gas tankers. If this plan occur the communities will endure more danger, contamination, and risks in security and health. In this summer we receive the good news that the DC Court of Appeals denied New Fortress their petition to be without FERC permit. That was a victory in this long and hard process.

The community had been supported in this journey by churches that also are suffering the injustices of FEMA that for the climate catastrophe of Hurricane María in Puerto Rico is requiring the ten percent of the repairing projects. Most of the small churches that continue serving in Puerto Rico in the main denominations does not have the ten percent and they cannot fix their temples and above those difficulties they continue serving in a loving and supporting way, but they also need justice. We know that in the Us Virgin Islands FEMA approved the full amount of the projects and did not require them the ten percent as FEMA is requiring the churches in Puerto Rico, we only ask also for justice in this area also.

We ask you that consider intervene in this process on behalf of the communities that are ignored by the local agencies and local courts but in struggle for their own environmental justice for their health and the old and young generations that live there. The USACE dredging will exposed more the communities and allow the increase on methane gas to Puerto Rico and the consequences that we describe earlier in terms of security, health, and climate change consequences. Thank you for your time and hear our claim, we need action, and we need that the agencies like EPA and FERC can help our communities in advocating in the USACE plan to not proceed with this dredging in the way and purpose they have it now.

Rev. Dr. Sary N. Rosario Ferreira,

El Puente Faith Committee
Iglesia Cristiana (Discípulos de Cristo) En Puerto Rico
Sary_mar@yahoo.com
787 b478-0793

Agosto 3 de 2022

Full Name (First and Last): Richard E Mabion

Name of Organization or Community: Building A Sustainable Earth Community

City and State: KANSAS CITY, KANSAS

Brief description about the concern: I would like to address the need for more research on the creation of Retrofitting Job Training and Employment opportunities for low-income residents in inner-city and rural communities. It is a known fact that every home and building in America needs to be retrofitted for energy efficiency reasons. While there are already ongoing attempts to fulfill the Retrofitting needs, purposely training members of the low-income communities for those jobs is not seen as the preferred method of achieving those two goals or objectives.

Brookings Institute recently shared two articles that support the need for additional research on low-income employment possibilities. The first one address that June's 2022 Jobs report showed a warning for social engineers regarding workers of color in America, and the 2nd article addressed a study of how job displacement affects Blacks, women, and non-degreed individuals the most.

What do you want the WHEJAC to advise the White House Council on Environmental Quality to do?:
As one of those boots-on-the-ground social engineers, I would like for the White House Environmental Justice Advisory Council (WHEJAC) to let the White House Council on Environmental Quality know that we out here in the field need their help in securing serious research that details the low-income inner-city, and rural employment circumstances.

That is my ASK.

These are the two Brookings articles I mentioned in my Public comments

Richard Mabion

Building A Sustainable Earth Community

J Gordon Community Development Corp

Kansas Sierra Club

<https://johnsavagegroup.com/consultants/>

www.breakingthesilence.us

June's jobs report shows warning signs for workers of color



While the U.S. economy added 372,000 jobs in June, Black unemployment remains almost double the national rate. Regina Seo, Anthony Barr, and Oluwasekemi Odumosu outline what it will take to boost labor force participation and create a more equitable workforce.

According to the latest Bureau of Labor Statistics (BLS) monthly jobs report, the U.S. economy added 372,000 jobs in June, while the unemployment rate remained unchanged from May, at 3.6%. Yet Black unemployment remains almost double the national rate (5.8%), and there are still 5.7 million people who are not in the labor force but who currently want a job, suggesting that the recovery has not fully pulled in workers at the margins.

In addition, COVID-19's impact on the labor market is ongoing and complex. In June, 2.1 million people reported that they were unable to work because their employer closed or lost business due to the pandemic, and 1.4 million people missed a full week of work due to illness—the highest number since February.



Regina Seo

Senior Research Associate - Brookings Metro



Kemi Odumosu

Oluwasekemi Odumosu

Research Intern - Brookings Metro



Anthony Barr

Senior Research Assistant - Brookings Metro



Andre M. Perry

Senior Fellow - Brookings Metro

In this blog, we highlight three important patterns affecting workers of color, including declines in labor force participation, uneven recoveries in the private and public sector, and growing cost burdens as prices increase. We also make recommendations for creating a resilient workforce with opportunities for workers at the margins.

THE LABOR FORCE PARTICIPATION RATE IS COOLING DISPROPORTIONATELY FOR BLACK WORKERS

Almost as many people left the labor force in June (353,000) as new jobs were added to the economy (372,000), and the labor force participation rate dropped by 0.1 percentage points, from 62.3% to 62.2%. Men and women showed identical rates of decline (0.2 percentage points), while Black workers showed the greatest decline (0.8) followed by Asian American workers (0.5). White and Latino or Hispanic workers' labor force participation rates remained the same, although the size of the white labor force declined.

This data suggests that Black and white workers left the labor force for different reasons. A large portion of white labor force exits were due to employed workers leaving the workforce; there were 137,000 fewer employed white workers and a 152,000 increase in white exits from the labor force. On the other hand, the loss of 166,000 employed Black workers does not fully explain the 291,000 Black exits from the labor force. The number of unemployed Black workers declined by 97,000, suggesting that these workers gave up their job searches due to discouragement and were not counted in the labor force. According to the BLS, there was a 14.9% increase in Black people who had not looked for employment in the previous four weeks but still desired a job.

Monthly changes of job market indicators for Black and white workers

According to the BLS, the number of workers aged 25 to 54 who left the labor force grew faster (at 2.7%) than those 55 years and over (1.1%). There was also a 4% increase in people with children under 18 that exited the labor force in June, suggesting that child care was an obstacle as school-aged dependents entered summer break. In addition, Black people with children under five were 12% more likely to have left or lost a job to care for their children, according to the Census Bureau's Household Pulse Survey.

Another possible explanation for the overall drop in labor force participation is the impact of long Covid. Brookings analysis from earlier this year suggests that 15% of unfilled jobs could be traced to long Covid, which can have disproportionate effects on minority households due to structural inequities in health care access.

PRIVATE SECTOR HIRING IS LEAVING OUT MARGINALIZED WORKERS, WHILE STATE AND LOCAL GOVERNMENT EMPLOYMENT REMAINS SLUGGISH

There were 140,000 more private sector jobs in June 2022 than February 2020, demonstrating what President Joe Biden has hailed as one of the fastest job recoveries in recorded history. But the aggregate recovery masks important differences across industries. For example, employment in the leisure and hospitality industry is still down 1.3 million (7.8%) compared to February 2020, and the social assistance industry (including child care) is down 87,000 jobs (2%).

While overall Black employment in the private sector reflects U.S. demographics, a McKinsey report on race in the workplace shows they are often over-represented in frontline positions and underrepresented in managerial positions. With 20 hourly jobs for every salaried job, Black workers are left with limited opportunities for advancement in position or pay; they are 23% less likely to receive meaningful support to advance and 41% less likely to view promotions as fair.

Although the public sector was not hit nearly as hard as the private sector, the number of government jobs remains 2.9% below its pre-pandemic level (664,000 fewer jobs). This slow recovery is especially concerning for Black workers, for whom public sector employment has long been a source of economic security and mobility. In 2021, 16.9% of public workers were Black, compared to the national Black population share of 12.3%.

Private sector jobs are recovering, but government jobs remain below pre-pandemic levels. State and local governments have been especially slow to recover, employing 656,000 fewer people compared to February 2020. Two years ago, at the outset of the pandemic-triggered recession, Brookings researchers warned against repeating the mistake of failing to shore up state and local government employment during the Great Recession, when cutbacks disproportionately affected public sector workers of color as well as middle-wage

and middle-skill jobs. While the federal response to the pandemic has been much more stimulative than in 2009, state and local employment rolls continue to lag, and some local economies have been hit harder than others.

AS INFLATION INCREASES, CONSUMERS ARE SPENDING MORE ON BASIC NEEDS

Although Americans' personal incomes increased by 0.5% in June, real disposable personal income decreased by 0.1% due to persistent inflation, which is currently 9.1% year-over-year, far outpacing the average wage growth of 5.1%. Thus, even though consumer spending increased by 0.2% in June, it was mostly driven by spending on housing and utilities, gasoline and other energy goods, international travel, and health care—all of which have seen rising costs.

The increased cost of rent is particularly concerning, as the end of the pandemic eviction moratorium has led to eviction filings rising above pre-pandemic rates in some cities. Prior Brookings research shows that renters in Black-majority neighborhoods face disproportionate rates of eviction, and research from the Washington Center for Equitable Growth shows that LGBTQ+ persons also experience disproportionate challenges in accessing affordable housing.

AMID GROWING ECONOMIC UNCERTAINTY, IT IS TIME TO CREATE A MORE EQUITABLE AND RESILIENT WORKFORCE

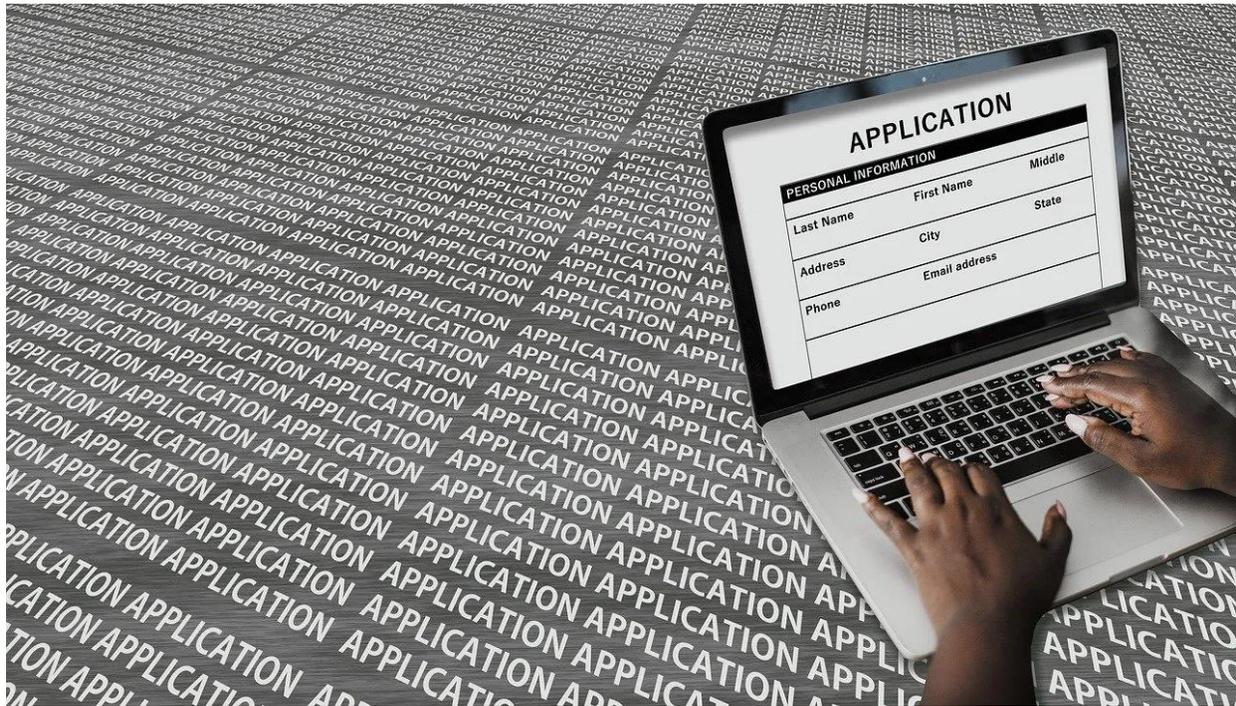
As the labor market cools and inflation surges, many Americans are fearful of losing their jobs. Young adults are particularly vulnerable; a recent Brookings analysis revealed that good jobs are out of reach for many 20-somethings. "For large shares of young people (and disproportionately those who are female, Black, and Latino or Hispanic), we have normalized a path from high school to low-wage employment, unemployment, and poverty," the authors wrote.

To strengthen labor force participation and create an equitable workforce, we need robust workforce preparation programs, including paid apprenticeships and work-based learning. Local and state governments can take the lead in some of this work, including by using American Rescue Plan Act and Infrastructure Investment and Jobs Act funds to create paid service corps that provide young talent with a pipeline into good jobs while also expanding public sector capacity.

These government workforce initiatives can also ensure we have the capacity to implement green infrastructure and other climate priorities, and provide early- to mid-career workers with job security.

STUDY: Job displacement affects Blacks, women, and non-degreed individuals most

by NNPA Newswire Senior Correspondent Stacy M. Brown



A new study focusing on job displacements between 1989 and 2019 found that, on average, Black workers are 67 percent more likely to be displaced than their white peers.

Research by the nonprofit Brookings Institution further revealed that workers without a bachelor's degree are also 67 percent more likely to be displaced than those with a bachelor's degree.

Additionally, workers whose parents are in the bottom half of the income distribution are 27 percent more likely to be displaced than those with parents in the top half.

Titled Job displacement in the United States by race, education, and parental income, the study noted that using an event study fixed effects model, researchers measured the impact of a given displacement on annual earnings by worker group.

They discovered similarly large and persistent adverse effects on earnings across all demographic and socioeconomic groups.

The study authors estimated a 57 percent decline in earnings following a displacement.

They also estimated a 25 percent decline in the 10th year after a displacement.

During the first months of the COVID-19 recession, an estimated 22 million Americans lost their jobs – roughly 13 percent of the U.S. workforce.

The initial impact on employment was largest for women, Black workers, Latino workers, and less-educated workers.

“This negative employment shock occurred against a backdrop of long-term trends of declining intergenerational economic mobility and high-income inequality across race and education levels,” the researchers explained.

The study examined how job displacements affect workers by race, education level, and parental income in the United States.

“An extensive literature in economics shows that workers experience large and persistent earnings losses following a job displacement,” Brookings researchers determined.

“Given the millions of workers displaced during the COVID-19 recession and the high-income inequality in the United States, it is important to understand the role that job displacement may play in driving inequalities across demographic and socioeconomic groups.”

The authors continued:

“In this [study], we use the Panel Study of Income Dynamics (PSID) to measure the frequency and earnings impact of job displacements by race, education, and parental income level.”

Meanwhile, the authors found that workers whose parents are in the bottom quintile of the income distribution are 27 percent more likely to be displaced than those with parents in the top income quintile.

The study concluded that Black workers, less-educated workers, and those with low-income parents are more likely to be displaced yearly.

But once they are displaced, do these workers experience worse outcomes than their white, more educated, and high-income-parent peers who also share a displacement?

“In the year following a displacement, workers without a bachelor’s degree experience a roughly 600-hour decrease in annual hours worked, while those with a bachelor’s degree see a 1,000-hour decline,” the researchers wrote.

“When we look at Black and white workers separately, we find nearly identical effects on earnings across the five years leading up to a displacement and the ten that follow.

However, while the effects are similar for both race groups, large differences in earnings levels still exist across all relative years.

“In the year after a displacement, non-displaced white workers earn roughly \$11,500 more than their Black peers, on average.”

Researchers said the report establishes three crucial facts about job displacements in the United States over the last 30 years.

First, as other studies have shown, the adverse effects of a job displacement on earnings, hourly wages, and annual hours worked are significant and persistent.

Also, certain workers experience much higher displacement rates than others in any given year.

Namely, Black workers, those without a bachelor’s degree, and those with low-income parents are much more likely to experience a displacement any given year than their white, degree-holding, and high-income-parent peers.

Finally, the negative effect of job displacement on earnings is relatively consistent across socioeconomic groups.

“While displaced workers with bachelor’s degrees seem to experience less severe earnings losses in the year immediately following a displacement, they also experience larger lingering effects than their peers without degrees,” the researchers asserted.

“However, large standard errors make it difficult to make strong claims regarding differences by socioeconomic status. It is important to remember that, despite the similar impact of job displacement across demographic and socioeconomic groups, there remain large gaps in average annual earnings across these groups – both before and after displacement events.”

They noted further that a critical implication of their findings is that job displacements may play a role in promoting racial, educational, and intergenerational inequality.

“Even though we do not find differences in the earnings effects of any given displacement across groups, we do find that certain groups experience displacements much more frequently,” the researchers insisted.

“Black workers, those without bachelor’s degrees, and those with low-income parents all have lower average earnings than their peers before experiencing job displacements, so the higher-frequency displacements for these groups likely exacerbate existing income differences.

“Focusing exclusively on earnings outcomes, our [study] does not fully capture the potential impact of being displaced. The job displacement literature has found that displacements affect many outcomes besides earnings, such as health and homeownership.”

This is a summary of my public comments at today's WHEJAC meeting. This list is not exhaustive but includes some of my top-of-mind thoughts on the scorecard, informed generally (though not vetted explicitly) by the needs, solutions and experiences I hear from EJHA affiliate communities in our ongoing dialogues and work together.

Apologies for the bullets and the awkward formatting; I quickly wrote this to keep myself on track in the comment and didn't have time to reformat, but thought I would also share here for the WHEJAC members since it was a long day.

THE SCORECARD MUST WORK IN CONJUNCTION WITH THE SCREENING TOOL.

- Benefits are not one size fits all and should be community defined. However, the EJ score card must use clear and consistent definitions of “disadvantaged community” and “investment benefit” in order for the scorecard to be able to meaningfully track progress across the federal government.
 - o Without consistent metrics and definitions across the government it will be impossible to see how agencies or programs live up to their stated goals, live up to J40 and stack up against other agencies/programs or regions/states.
- The EJ scorecard should track where federal dollars and “investment benefits” flow to the most granular geographic level possible. By county or zip code is not adequately specific to show patterns in public health or environmental injustice because these are often hyperlocal. (This is particularly important in communities that are very rural or very urban, as the data get skewed by spreading it out over a large physical area or a large population number.)
- The EJ scorecard must track where federal dollars and investment benefits flow by the race and income in communities at the most granular level possible in order to show which communities are receiving benefits.
 - o It will be impossible to show whether Justice40 and other EJ initiatives are working to address environmental racism or actually benefiting EJ communities if this data is not collected and made public.
 - o This must include federal investments that don’t flow directly from the federal agencies to communities—such as funds that are disbursed to states or through NGOs. If every state is able to make up their own metrics and definitions it will be impossible to meet the mandate of more equitably distributing federal investments—particularly in states like TX, LA and others where state governments are hostile to EJ communities.
- There MUST be an opportunity for communities to meaningfully engage in the development of and the ground-truthing of the EJ scorecard (and the CEJST).
 - o This includes:
 - ☐ The opportunity for communities to self-designate as disadvantaged (with some transparent process for vetting).
 - ☐ The opportunity for communities to fact-check whether they actually did receive benefits from these federal investments that the agency is claiming or the scorecard is indicating.

- The EJ Scorecard should track not only what agencies or CEQ consider “benefits” but also negative unintended (or intended) consequences of federal investments and actions.
- o New investments in hydrogen and carbon capture projects like those that were discussed in today's DoE presentation are a good example of the potential for investments from programs that fall under J40 to have deleterious effects on health and the environment, particularly in EJ communities.
- o These negative impacts should be factored into the scorecard along with the beneficial impacts.
- To the maximum extent possible the scorecard should account for cumulative impacts, at least of any new federally funded programs and projects in a community, and realize that different agencies and even different offices within the same agency may be working very differently in/with a community, or even working at cross purposes if agencies are not coordinating with one another.

Thank you for the opportunity to provide comments to the WHEJAC on the development of the federal Environmental Justice Scorecard.

Stephanie Herron

National Organizer

Environmental Justice Health Alliance for Chemical Policy Reform (EJHA)

Are you able to help us? The odor, emissions, fumes and dust also the rumbling and vibration. I have included a complaint filed with DEQ. This is a daily occurrence I could easily file multiple complaints on a daily basis, but I do submit a complaint weekly. We have previously call the sheriff department, but they say it is up to the county, contacting the county Fitzgerald Barnes and Robert Gardner your emails and calls are ignored. We were told by Fitzgerald Barnes early on it is between us and the company.

This company know that DEQ and other organizations are short staffed.

It is clearly apparent this plant and chemical are harmful to people, animals, and the environment. The odor will take your breath, cause your throat, nose, eyes and chest burn, headaches and dizziness.

Can you please help us?

Thank you for your time,

Theresa Coffey