U.S. Environmental Protection Agency Board of Scientific Counselors

Sustainable and Healthy Communities Subcommittee

Virtual Meeting Minutes

March 30, March 31, April 1, 2021, and April 16, 2021

Dates and Times: March 30, 2021, 11:00 to 5:30 p.m.; March 31, 2021, 11:00 to 4:30 p.m.; April 1, 2021, 11:00 to 2:30 p.m. Eastern Time; April 16, 2021, 2:00 to 4:00 p.m. Eastern Time

Location: Virtual

Meeting Minutes

Provided below is a list of the presentations and discussions that took place during the meeting with hyperlinked page numbers. The minutes follow. The agenda is provided in Appendix A, the participants are listed in Appendix B, and the charge questions are provided in Appendix C.

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Tuesday, March 30, 2021

The meeting in general followed the issues and timing as presented in the agenda provided in Appendix A of this meeting summary.

Meeting Kickoff, Federal Advisory Committee Act Rules, Expectations, and Logistics

Tom Tracy, Designated Federal Officer, Office of Science Advisor, Policy, and Engagement

The meeting convened at approximately 11:00 a.m., Eastern Time. Mr. Tom Tracy, Designated Federal Officer (DFO) for the U.S. Environmental Protection Agency (EPA) Board of Scientific Counselors (BOSC) Sustainable and Healthy Communities (SHC) subcommittee, thanked the members for their attendance. He discussed Federal Advisory Committee Act (FACA) stipulations governing the meeting, which require the meeting is open to the public and with time reserved for public comments. He shared there was no public comment, and he said BOSC SHC subcommittee members had no conflicts of interest.

Savannah Bertrand reviewed SharePoint logistics.

Office of Research and Development Welcome

Chris Frey, Deputy Assistant Administrator, Office of Research and Development
Jennifer Orme-Zavaleta, Principal Deputy Assistant Administrator for Science, Office of Research and Development

Dr. Jennifer Orme-Zavaleta introduced herself and welcomed BOSC SHC subcommittee members and participants to the virtual meeting. She stated that EPA's Office of Research and Development (ORD) values the input from the subcommittee as they work on research, planning, and implementation. She discussed the challenges that have been faced in research from teleworking for more than a year. Several of EPA's facilities have remained open and are focused on keeping the workforce safe.

Dr. Chris Frey introduced himself and thanked the participants for their attendance. The SHC Research Program has a strong foundation for addressing key challenges. The program is committed to mapping and identifying solutions and will continue to work to improve the lives of Americans. Among the Biden-Harris administration, there is a deep commitment to scientific integrity.

Subcommittee Chair Opening Remarks and Introductions

Courtney Flint, Chair

Dr. Courtney Flint gave a brief overview of the meeting agenda, charge questions, and charge question breakout groups. She stated this review emphasizes the implementation of the research. The BOSC SHC subcommittee members introduced themselves with affiliation.

Sustainable and Healthy Communities Research Program Opening Comments

Tom Holdsworth, Acting Principal Associate National Program Director, Sustainable and Healthy Communities Research Program

Tom Holdsworth introduced the SHC Research Program national program director team, connections to centers and offices, and program support staff. He highlighted the research areas that would be discussed. The charge was to develop a problem statement. He gave an overview of the four centers, including the Center for Public Health and Environmental Assessment (CPHEA), Center for Computational Toxicology and Exposure (CCTE), Center for Environmental Measurement and Modeling (CEMM), and the Center for Environmental Solutions and Emergency Response (CESER). He described the focus areas and outputs.

Research Implementation Approach Between the Office of Research and Development and the Office of Land and Emergency Management

Carlton Waterhouse, Deputy Assistant Administrator, Office of Land and Emergency Management

Carlton Waterhouse thanked EPA's ORD and BOSC for their work and for the invitation to provide feedback on the SHC Research Program. We worked closely with impacted communities and moving forward, we anticipate increasing our efforts in environmental justice. My hope is that the BOSC SHC subcommittee will include in consideration whether the work will include our offices efforts. He noted the SHC Research Program provides important support for the Office of Land and Emergency Management (OLEM).

Implementation of Mining and Underground Storage Tank Research in the Center for Environmental Solutions and Emergency Response

Greg Sayles, Center Director, Center for Environmental Solutions and Emergency Response

Dr. Greg Sayles outlined research focused on remediation of mining waste, mine wastewater source control, and assistance, and methods to control corrosion. ORD and CESER prioritize supporting partners.

Charge Question 1: Treatment and Control of Mining Wastes

Greg Sayles, Center Director, Center for Environmental Solutions and Emergency Response

Dr. Sayles presented the charge question. What recommendations does the BOSC subcommittee have on this research to include ORD's development of innovative approaches to the remediation of mine waste, mining-influenced water, and mine-wastewater source control. What recommendations do you have for ORD to enhance the transfer of innovative technology for field-ready application?

Geochemical Characterization of Acid Mine Drainage

Richard Wilkin, Senior Research Scientist, Center for Environmental Solutions and Emergency Response

Richard Wilkins presented work on the geochemical characterization of acid mine drainage, which is caused by the oxidative weathering of metals. ORD supports EPA Region 8 at the Captain Jack Mill Superfund Site. He also discussed Research Area 2.2. geochemical tracers for groundwater remediation and Research Area 2.6. Safe and Sustainable Water Resources (SSWR)

Research Area 1.6 (research support for the San Juan Watershed Program) is related to this effort.

Evaluation of a Permeable Reactive Barrier for Treatment of Acidity and Heavy Metals in Groundwater

Ralph Ludwig, Environmental Scientist, Center for Environmental Solutions and Emergency Response

Dr. Ralph Ludwig presented research to evaluate the permeable reactive barrier (PRB) (composed of limestone gravel and composted cow manure) for addressing acidity and heavy metals present in groundwater. Key aspects of PRB performance include treatment effectiveness, hydraulic property changes over time, PRB discharge quality, reactive media longevity, and contaminant removal permanence.

Isolation of Mine Waste Field Pilot

Ed Barth, Senior Researcher, Center for Environmental Solutions and Emergency Response

Ed Barth presented a pilot field study focused on isolating mine waste, which includes mine tailings.

Soil Amendment Technologies to Stabilize Mercury

Todd Luxton, Chemist, Center for Environmental Solutions and Emergency Response

Todd Luxton presented on soil amendment technologies used to stabilize mercury, which contaminates sites across the United States. He shared Regional Applied Research Effort (RARE) project examples of elevated mercury levels. He also discussed EPA's long-term anticipated impacts, which include providing improved technical support to partners facing issues with mercury contamination, leading to best practice guidance for regions and states.

Hardrock Mining Remediation Challenges and Treatment Technologies

Barbara Butler, Environmental Engineer, Center for Environmental Solutions and Emergency Response
Ian Bowen, Geologist, EPA Region 8

Barbara Butler shared that EPA's Hardrock Mining Conference will be held in 2022. This conference provides a forum for exchanging scientific information on current and emerging approaches for characterization, monitoring, treatment, and remediation.

Ian Bowen discussed impacts from ORD's hardrock research and how ORD's resources have benefited EPA Region 8 sites. He shared research outputs that were shaped by challenging site environments, and he answered the SHC Subcommittee members' questions.

- **Courtney Flint:** How much does the availability of materials for remediation affect the selection of materials used in the study of remediation?
    - **Ralph Ludwig:** Organic substrates and limestone are easy to obtain. Zerovalent iron is optimal in some circumstances.
- **Lee Rhea:** Does the analysis include a randomized complete block design?

  - **Ed Barth:** We are going to composite the waste before it is placed and randomize where it is placed. We still have time to decide if we will randomize the design or the placement.
- **Jay Golden:** Is EPA focused on supplemental technology designs for remediation for areas that do not have existing mining operations? What is the objective and how does it integrate with existing mining operations, stand-by operations, and historic old mining sites?
  - **Tom Holdsworth:** The research that we are presenting here is focused on contaminated sites. We are not averse to partnering with industry, but those opportunities are limited. Due to reduced budgets and staffing, we have not been doing as much outreach as we should.
  - **Jay Golden:** Is there a stated goal for abandoned mines and contaminated sites?
  - **Tom Holdsworth:** This issue will be discussed in an upcoming presentation from Dan Powell.
- **Courtney Flint:** At the regional level, do you interact with industrial partners?
  - **Ian Bowen:** Yes and no. Interaction is primarily focused on abandoned mine sites with no responsible party. There is little to no funding for industry partners to assist. In cases with active mining operations, I do have contact though there is not direct research translation.
- **Leslie Rubin:** Would they be characterized as Superfund sites?
  - **Ian Bowen:** Some of the sites are listed as Superfund sites. There are 300 abandoned sites within one Superfund site. The Captain Jack Mill site is a Superfund site.
- **Matthew Naud:** Are most mine sites abandoned and under federal jurisdiction? Are these sites on federal, state, or tribal lands?
  - **Barbara Butler:** I am unaware of how many mine sites are under each type of land. Dan Powell might be able to address that question. Many mines have mixed ownership. Many sites are not listed as Superfund sites due to the lack of human-health impacts.
  - **Jay Golden:** For context, there are 100,000 abandoned mines in Arizona.
- **Rainer Lohmann:** How was the PRB scaled and designed? Given that it is successful, do you have enough knowledge to use it at a different site?
  - **Ralph Ludwig:** At the first site, ground water flow is slow, the ground water is not highly oxic so that helps with longevity. Performance is a site-specific issue.
  - **Ian Bowen:** Water geochemistry matters for PRBs.
  - **Courtney Flint:** Is this in the research portfolio for PRBs?
  - **Rick Wilkin:** The literature has focused on short-term evaluations. EPA is looking at longer-term evaluations and has found that it is site-specific.
- **Mike Steinhoff:** There is a lot of work invested into the pilot studies. Is work being done to develop broader guidance, such as determining when certain remediation strategies are called for?

  - **Rick Wilkin:** Those products are in the pipeline. In Research Area 2, there is an objective to synthesize what we have learned and provide that information to regional partners.
- **Jim Kelly:** If the goal is to grow plants to cover the area, is that enough to account for all the things that can inhibit plant growth?
  - **Todd Luxton:** It is site-specific. With the cinnabar mine it is difficult to get anything to grow on the soil. Looking at other sites, we must consider soil conditions that are specific to that site.
  - **Leslie Rubin:** I found the unintended consequence of the mercury methylation by the organic material to be a revelation.
  - **Todd Luxton:** Having an idea of unintended consequences of the remediation is important. Low concentrations have big effects on the food web.
- **Lucinda Johnson:** Have you considered the type of biochar and how to weigh the different types in their applications?
  - **Todd Luxton:** We are looking at three sources of biochar. A plant-based material, a manure-based material, and a blend of the two. We are looking at synthesis at different temperatures.
- **Elena Irwin:** When we are looking at research level, we are not fully capturing the social damages from the downstream effects. What effort, if any, is there with watershed-scale analysis?
  - **Tom Holdsworth:** There is some product-level work that is going on.
  - **Rick Wilkin:** There is work to look at the cleaning that is occurring in the mine site and how that translates to changes in the watershed.

BOSC Subcommittee Discussion and Questions and Answers

Courtney Flint, Chair

Charge Question 2: Underground Storage Tanks

Tom Holdsworth read the charge question and introduced the presenters.

Mark Barolo introduced underground storage tank research. This research relies on ORD to help identify problems and develop practical solutions. He highlighted four key challenges, which include cleaning up the sites and the need for better data. The partnership with ORD is important. ORD have been collaborative, and customer focused and are focused on meeting real-world needs.

Fran Kremer gave a broad overview of the research.

Underground Storage Tank Web Application V1.0 and V2.0

Alexander Hall, Geographer, Center for Environmental Solutions and Emergency Response

Alexander Hall discussed the national database on underground storage tank infrastructure, called Underground Storage Tank (UST) Finder. Knowing the location of USTs and facilities is

important to researching potential health impacts. UST Finder is divided into three sections, and there are times when tanks are also divided into different compartments. He framed this topic in terms of environmental justice relating to low-income communities experiencing environmental burden of UST and leaking underground storage tanks (LUST). He provided graphs relaying environmental justice concerns. The DRASTIC index is expanding on work EPA created in 1982. He gave differences between traditional modeling approaches and machine learning approaches.

Diving Ground Water Plume Application

Ralph Ludwig, Environmental Scientist, Center for Environmental Solutions and Emergency Response

Ralph Ludwig discussed a tool that was developed to assist with groundwater contaminant plumes. Contaminant plumes follow direction of groundwater flow and can move downward (and upward) in aquifers. When characterizing a site, there could be a substantial vertical component. He gave examples of questions that should be asked. The Diving Plume Calculator aims to predict vertical zones in aquifers where contaminant plumes are likely to reside and to ensure well screened intervals match the location of the plume. The motivation for plume diving work began in New York States Department of Environmental Conservation (NYS DEC) where a plume began to descend under a gravel pit. The model was developed around the data from this site. This tool can be applied to address the impact of extreme events with contaminant transport. The current calculator addresses homogeneous aquifers with level or sloping aquifer bases. The level base is a piecewise segmented flow path. A schematic of the model was shown. This model was built on the Java Applet, which is no longer supported. He discussed on-going and future work for the model.

Identify Corrosion Processes Occurring in Underground Storage Tank Systems Based on Infrastructure and Fuel Type

Fran Kremer, Center for Environmental Solutions and Emergency Response

"Assessing Corrosion in the Tanks Infrastructure" Identify Methods to Assess Corrosion Processes Based on Tank Infrastructure and Fuel Type

Fran Kremer, Center for Environmental Solutions and Emergency Response
Mark Barolo, Acting Director, Office of Underground Storage Tanks

Dr. Fran Kremer discussed the focus of the research program is on cleanup and corrosion. Efforts are focused on examining underground storage tank (UST) systems to understand where vulnerable portions of tanks are before leaks occur. The research is focused on controlling corrosion in tanks to prevent these leaks from happening. She mentioned the external partners and how they are helping to influence and improve this work. She mentioned next steps of corrosion research. Next steps include conducting screening studies to examine the range of fuel types, and concurrently working with state partners. The outcomes of research are to develop sentinel methods for states, owners, and operators to assess corrosion in operating tank systems

to prevent system deterioration. Providing critical data on vulnerable system materials as a function of infrastructure, fuel type, and the environment is another outcome. She briefly covered the work focused on virtual training. This is helping emergency responses operations and various tank programs.

BOSC Subcommittee Discussion and Question/Answer

Courtney Flint, Chair

- **Derek Shendell:** Are there plans to move beyond pamphlets and tutorial videos?
    - **Fran Kremer:** The workshops are now being recorded and are available to the states. Workshops are principally for public organizations, not private. The national webinar is also posted.
- **Courtney Flint:** Is this integrated into the EnviroAtlas?
    - **Alex Hall:** It is not. It is a complex, stand-alone dataset.
- **Elena Irwin:** There seem to be many applications and opportunities on making this available. You explained some of the environmental justice work. Can you explain where you want to go with environmental justice work? Also, from a cost-benefit point of view, how do you prioritize?
    - **Alex Hall:** We are currently working with the Office of Environmental Justice to incorporate this as the premier environmental justice tool. There are discussions on how to best make this work. We are in the middle of writing a manuscript of writing outcomes, nationally and on the state level.
    - **Fran Kremer:** To address the remediating 60,000 sites in the backlog, UST Finder will help to understand where contamination could be moving. This will overlap with what we are working with Office of Water on. This will help state and local communities to triage underground tanks to protect their water quality.
    - **Mark Barolo:** Identifying sites is important. All sites move forward if it works how it is supposed to. There are cases where this does not work.
- **Jim Kelly**: It is difficult to convey the impact of historical factors and that proximity is not the only factor with a data layer. We need to be careful to not convey that the situation is worse than what it is. It is important to be wary of these correlation versus causation factors and not solely determining public health outcomes based on proximity.
    - **Alex Hall:** With this first cut of research we show what it is like now and the outcomes. We do not want to draw those connections. We avoid explaining causation.
    - **Fran Kremer:** It is an important element to consider causation, but it is not a space we are engaged in directly.
    - **Mark Barolo:** An underground storage tank is not always a problem for a community. We are trying to think carefully about location information and what it means in terms of what we can do differently. The data is the beginning of the conversation.

- **Elena Irwin:** You are compiling all these data together, have you thought about using this as a way for people to do their own weighted index or interactive map making?
    - **Alex Hall:** We can compile data from a wide variety of communities and demographics that can be impacted. We try to make this data available and flexible by allowing users to export. We are not alleging that we know what to do with the data. We want people to use it how they see fit.
- **Leslie Rubin:** Historically, was the chance of Lead containing gasoline leaking into the soil and perhaps resulting in contamination of the soil around the tanks?
    - **Alex Hall:** It has been a while since you could use Lead infused gasoline. Within UST Finder, you can get results based on certain filters.
    - **Leslie Rubin:** Could there have been leakage in the past that has not gone away?
    - **Alex Hall:** UST Finder allows you to examine historic tanks. This will allow you to examine various aspects.
    - **Mark Barolo:** ORD did a lot of work with this. It has taken part in the remediation component of the program for a while. There should not be many new releases.
- **Leslie Rubin:** In North Carolina there is a situation where poor Black communities rely on their own wells for drinking water and personal use. Are there issues around storage tanks in North Carolina?
    - **Fran Kremer:** We will have geospatial information on North Carolina tanks and facilities by census blocks.
    - **Mark Barolo:** That is true in North Carolina and anywhere where private wells are the primary source of drinking water.
- **Rainer Lohman:** How much data do you need to have? Can you easily put this into any size data because you know the hydrology well enough?
    - Ralph Ludwig: Specific input parameters are required. It is a heterogeneous model, and it is not going to be a three-dimensional model. This is a tool to help guide or provide insight to where the plume might be moving vertically.
- **Jay Golden:** Does UST Finder link to aboveground storage tanks (ASTs)? Aboveground storage tanks have posed no lesser threat than underground storage tanks.
    - **Fran Kremer:** There are some parallel in terms of understanding sources of contamination. We work with the Office of Underground Storage Tanks and are dedicated to boundaries of research we can take on through these offices.
    - **Alex Hall:** Many aboveground storage tanks have underground storage tanks, which adds complexity to this issue. The tier 2 data is not publicly available, and EPA does not have access to it unless they make a request to the states, causing a data flow issue.
- **Courtney Flint:** Relating to leaking underground storage tanks, what updates do you have about streamlining state approaches? Is UST Finder bridging misalignments across states?

  - **Mark Barolo:** A continuing effort of the program is to decrease the backlog. The program was designed for states to take lead in making decisions on when sites are ready to close. There are different approaches in each state. I am not sure of the gaps you are alluding to. If it is variation among states, that certainly remains. We work within whatever the states approach is.
  - **Courtney Flint:** Five years ago, it seemed that varying approaches were an obstacle. You are working within their context and adapted to the variations.
  - **Fran Kremer:** I think also having the national database is giving us uniformity. In version 2, we have been working with regions and states.
- **Derek Shendell**: Is information on military bases in the current UST Finder?
  - **Alex Hall:** In version 1 of UST Finder, the public-facing dataset, we worked with a public defense agency, the Army, and the Air Force. We do have the information, but it is no longer public facing.
- **Matthew Naud:** The transparency in getting these data down to local communities is important. Often local communities have opportunities, if access to data, that states do not.
- **Mike Steinhoff:** What is the process for determining the most helpful way to bring that model back using the framework that avoids deliberations, where an old model cannot run anymore?
  - **Ralph Ludwig:** We know the platform this was originally built on is no longer supported by browsers, so it will be going onto the Java platform. We are not sure if this will be supported for years to come, but it is our hope that we will not have to make this transition down the road.

Adjourn

The meeting adjourned at 5:00 p.m., Eastern Time.

Wednesday, March 31, 2021

Welcome – Day 2

The meeting reconvened at approximately 11:00 a.m., Eastern Time.

BOSC Subcommittee Chair Opening Remarks

Courtney Flint, Chair

Dr. Courtney Flint thanked the BOSC SHC subcommittee and participants for their time and effort. Today, there will be more information provided on the structure of writing and delivering the report as discussions progress.

Public Comments

Tom Tracy, Designated Federal Officer, Office of Science Advisor, Policy, and Engagement

No public comment

Implementation of Solvent Vapor Intrusion and Lead Research in the Center for Environmental Measurement and Modeling

Tim Watkins, Center Director, Center for Environmental Measurement and Modeling

Dr. Tim Watkins introduced the topics that will be covered in today's presentations. CEMM provides cutting-edge and innovative measurement and modeling approaches. Vapor intrusion work is occurring in two centers in collaboration with OLEM, regions, and states. Lead continues to be a high priority for the EPA and the research expands across all four centers. Research includes identifying and mapping areas of high lead exposure, providing estimates of soil and dust ingestion, and developing and characterizing bioavailability and bioaccessibility. The SHC Research Program expanded its research and added the assessment and mitigation of apartment buildings and added collecting data and modeling related to temporal and spatial variability. Dr. Watkins reviewed the relating charge question.

Charge Question 3: Solvent Vapor Intrusion

Tim Watkins, Center Director, Center for Environmental Measurement and Modeling

Dr. Tim Watkins read Charge Question 3 and introduced the speakers that will present information on the topic.

Characterize Vapor Intrusion in Large Multi-component Buildings

Brian Schumacher, Associate Director of Science, Center for Environmental Measurement and Modeling

Dr. Brian Schumacher gave a high-level overview of Research Area 3. He described vapor intrusion as the migration of vapor-forming chemicals from a subsurface source into an overlying building or structure via any opening or conduit. He gave a brief description of EPA vapor intrusion guidance and ORD's history of research on vapor intrusion. Vapor intrusion partner needs of characterizing and remedying vapor intrusion. Dr. Schumacher discussed the three outputs in Research Area 3 and the objectives of each output. He presented graphs of preliminary screening data from radon exposure relating to research in Output 3.1. He noted a

few twists and turns in the research that were unexpected because of the climate in Fairbanks, Alaska. Fairbanks has several district heating systems that heat the water at a central location and pump the water to various locations. Some of the buildings in the plume have this system, so it will be monitored to see if this influences the outcome. He discussed the next steps of the research. The team is waiting for COVID-19 to be over before continuing intensive sampling research. There is a sub study for surrogate depth sampling. Dr. Schumacher gave a high-level overview of this study.

Field Testing and Data to Update Guidance on Subslab Sampling of Soil Gas

John Zimmerman, Research Physical Scientist, Center for Environmental Measurement and Modeling

John Zimmerman introduced Output 3.2: Subslab. He discussed the first objective of this output is focused on research in a large Department of Defense (DoD) building in Norfolk, Virginia. He discussed the details of how the research is carried out to examine spatial and temporal variability. There was a "hexagonal" grid designed to test various subslab ports. He described the different types of subslab sampling and shared preliminary results through several graphs. The second objective is to conduct a study to determine and validate the effectiveness of high-volume sampling for vapor intrusion investigations and to provide data for comparison to the other sampling data collected at the site from six sampling points.

Alan Williams discussed the objectives for Output 3.3: Variability. He mentioned the technical support activities that are related to this work. He gave a brief description of the products that will result from the research. With the anticipated results, EPA will be able to provide better guidance on sampling for vapor intrusion, provide better guidance on developing site conceptual models related to vapor intrusion sites, and provide better guidance on subslab sampling for vapor intrusion. States and communities will be able to better characterize their contaminated sites.

Data Models of Temporal and Spatial Variability in Vapor Intrusion

Brian Schumacher, Associate Director of Science, Center for Environmental Measurement and Modeling

Henry Schuver, Environmental Scientist, Office of Land and Emergency Management

Henry Schuver discussed the conceptual wish-list. The team would want to be able to identify buildings at-risk for vapor intrusion, COCs-for-vapor intrusion in the soil gas, and baseline measurements showing elevated soil gas intrusion into indoor air. If all these things were present, there would be a complete pathway to examine exposure pathways.

BOSC Subcommittee Discussion and Question/Answer

Courtney Flint, Chair

- **Courtney Flint:** This is a call for interdisciplinary research and practice in these areas. How well positioned are the research teams in these areas to address to the interdisciplinary aspects?
    - **Brian Schumacher:** Within ORD, we have the scientist's side of it. We are gaining more economists. Regarding sociologists, I would have to ask for input. We are gaining on those types of things.
    - **Henry Schuver:** We would not be averse to having them through contracts. There are experts out there that could be helpful to us.
    - **Courtney Flint:** There seems to be capacity for this across the SHC Research Program.
- **Barret Ristroph:** I was intrigued to see the map of Fairbanks, Alaska. I had never heard of district heating. I was thinking of places where there are oil spills. You do sample volatile organic compounds (VOCs) but not petroleum. How do you know what to focus on?
    - **Brain Schumacher:** Within EPA, their LUST program addresses petroleum products. We are focused on the chlorinated solvents portion. Within the ORD, petroleum has primarily occurred in the Oklahoma office. There is a scientific side that because of a petroleum product, they biodegrade which adds another variable to the distribution. Taking out one variable of biodegradation. With respect to what to focus on, we want to have a known contaminant plume. We ask states and program offices for their input.
    - **Barret Ristroph**: For choosing the areas, from the environmental justice angle, you go where there is known contamination. Are there many places around the United States that should be getting sampled but are not because there is not a known contamination? How do you address that possibility?
    - **Brian Schumacher:** We know there are sites where spills occur that we do not know about. If it is an environmental justice community or not, we do not know about them. We have done studies in the past in environmental justice communities. We are aware of the environmental justice communities, but it is not a primary focus to pick them.
    - **Henry Schuver:** Most of the facilities and sites for vapor intrusion are particularly urban areas. It is a frequent problem that the traditional approach does not work.
- **Barret Ristroph:** How does climate change alter the ways vapor is put into buildings?
    - **Brian Schumacher**: We did a short study in Puerto Rico. It depends on where you are. When you do higher heating in places such as Fairbanks, this will cause vapor intrusion.
- **Don Nelson**: For site selection, there was mention of 9 separate projects that would be put in the same place. Why did this not happen? How are you going to put the data together?

  - **Brian Schumacher**: It is difficult to find a large building that we have free access to. The building on the DoD base, the groundwater was present. We had to split them up because of this. There was also an older building in New Hampshire, but part of the ceiling was falling apart. We then moved to the large building aspect of it and picked the colder climate. We wanted to cover several building sizes to compare.
  - **Don Nelson:** Does that effect the way you will create the guidance?
  - **Brian Schumacher**: It will not change, so we can consider that a constant. The building sizes will not be a constant. The substantial change will be climate. We will figure out how to do the comparisons with the data and draw conclusions based on that.
- **Don Nelson**: There is always constraints to research. What are the distinct types of extreme events and what are their impacts? If you had no limits on money or labor, how long would you aim to monitor these sites?
  - **Brian Schumacher**: I would say about 3 to 5 years. Our studies are 15 months so we can see the comparisons of the starting season in two different years. The data for Virginia is being wrapped up now. We have seen in that building the direction of the winds spiked the vapor intrusion. The angle of the building to winds can also have an influence on the vapor intrusion at that location.
  - **Courtney Flint**: Do you have systematic insights on changes in barometric pressure? What are household practices that could affect it?
  - **Brian Schumacher**: We have differential pressure monitors to monitor activities. It is one of the bigger factors to start exploring those events of pressure or temperature. Pressure is affected by the wind.
  - **Henry Schuver**: In some houses in New Jersey, opening windows increases the levels because effective forces are drawn in. There are scenarios where opening windows draw in higher levels than previously. They vary across time and are building specific.
- **Derek Shendell**: Some of my research here in New Jersey relates to Radon with EPA and the local health department. We found other pathways for radon to get into homes, especially in older homes, through sunk pits, depending on the square footage, and through French or perimeter drains. Are those considerations for the larger commercial or multi-family apartment buildings? I am not sure how this would work if the basement were unoccupied for the most part?
  - **Brian Schumacher**: Those are what we consider as preferential pathways. When you have a hole in the basement and have the utility lines, that is a much faster pathway for vapor to flow than through undisturbed soil. It is a shorter way because the vapors do not have to progress through the pore spaces within the soil and would bring the vapor right into the subslab or into the basement itself. In the basements in Indianapolis, we had cisterns filled up with sand and put a 2-inch layer on top of it.

  - **Derek Shendell**: From the public health and epidemiology perspective, is it fair to say that the focus was on the basic physical and engineering sciences, and that you are less worried about being less regionally represented?
  - **Brian Schumacher**: You are correct. We are examining the scientific processes.
- **Jim Kelly**: What is the rationale behind the high-volume sampling versus the traditional sampling methods? How is using a periodic high-volume sampling different than using a mini-sampling volume system?
  - **Brian Schumacher**: The idea is that you have a better chance of being representative of a whole if you sample more area underneath a building's slab. You are right, if you keep doing high-volume sampling enough, you already remediated it.
- **Leslie Rubin**: I noticed a focus on using an interdisciplinary approach, we cannot address these issues unless we have people with different perspectives. What should we teach the next generation to allow them to address these issues at a larger degree?
- **Rainer Lohman**: Is there another way of building your own home or teaming up with other entities that build homes for research?
  - **Brian Schumacher**: That is generally not within our budget.
  - **Courtney Flint**: It seems that if you could articulate what you need in a site to partnerships, that might expand the possibilities.
- **Courtney Flint**: In addition to peer-reviewed journals, how else are you making available this work to a broader array of stakeholders?
  - **Brian Schumacher**: We have been asked by OLEM to produce the EPA project report. We have also made databases such as the Indianapolis database. As far as communication goes, we also present this at national meetings. He asked Henry Schuver to add to the distribution of information to the public from the OLEM perspective.
  - **Henry Schuver**: We do not have a lot of experience in communication to the public in general and it is an excellent idea. We have public relations positions, but a contracted sociologist could help with the depth of issues involved in a case work.
  - **Courtney Flint**: In addition, at the professional level, people might not have time to read the literature or attend the conferences so I believe expanding the communication will help make the work accessible to a wider audience.
  - **Leslie Rubin**: The Environmental Health Specialty Unit could produce one page fact sheets. We could also involve the university students.
  - **Brian Schumacher**: For most of our reports we produce fact sheets. In terms of students, we involve the Oak Ridge Institute for Science and Education (ORISE) training program.
  - **Leslie Rubin**: Could we get a sample of the fact sheets? The Pediatric Health Specialty Units could distribute them if they have relevance to children.

Charge Question 4: Chemicals of Immediate Concern (Lead)

Jennifer Cashdollar, Microbiologist, Center for Public Health and Environmental Assessment

SHC has expanded its research on lead (Pb) exposure and mitigation in response to agency priorities, OLEM, regional, and state needs, and as part of the federal action plan to reduce childhood Pb exposure and associated health impacts. Efforts include methods to identify locations of high Pb exposure, evaluating bioavailability of Pb in ingested soil and dust, and reducing the cost of remediation. She asked the BOSC subcommittee to provide recommendations on the approach, structure, and components of this research to increase confidence in science-based methods.

Collaborative Science-Based Approaches and Results to Identify High Lead (Pb) Exposure Location in the United States and Key Drivers at those Locations

Valerie Zartarian, Research Environmental Engineer, Center for Public Health and Environmental Assessment

Alan Walts, Director, Tribal and Multi-media Programs Office

Valerie Zartarian discussed the collaborators and partners. Alan Walt described how the workgroup was formed to have environmental public health agencies work together. He discussed how a strong science-based approach was necessary to support effective joint-planning. They submitted science support request after hearing about the work.

Valerie Zartarian shared the technical assistance ORD provided to EPA Regions 1, 4, 5, 6, and 7, for 24 states. Alan Walts discussed the applications and how to directly translate research into the field.

Valerie Zartarian explained the need for science-based approaches to effectively target and prioritize lead actions in the most disproportionately impacted locations and overburdened communities. She described EPA's EJSCREEN 2017 Pb Paint and Environmental Justice index.

Alan Walts shared expected impacts to inform EPA and states.

Valerie Zartarian discussed the data sources used and Pb indices. ORD analyzed and mapped three available exposure indices and models with cluster analysis. She also described the blood lead level (BLL) data sources.

Alan Walts concluded by discussing the importance in the risk communication and the need for social science to support communities in catalyzing change.

Health Effects of Changing Lead Exposures and Community Factors Which May Alter Potential Health Benefits

Lauren Wyatt, Environmental Health Scientist, Center for Public Health and Environmental Assessment

Lauren Wyatt presented on addressing health effects associated with changing Pb exposure and community factors that impact health benefits. She shared how lead exposure remains a concern

despite reductions in BLL. Outcomes of interest include behavioral, developmental, cardiovascular, renal, and general disorders. The work will draw upon electronic medical records. Partners for the project including the North Carolina Department of Health and Human Services (NC DHHS), EPA Region 4, and EPA Office of Children's Health Protection. The project is in the early stages.

Methods and Approaches to Improve Accuracy, Reliability, and Confidence of Children's Soil and Dust Ingestion Rates

Nicolle Tulve, Research Physical Scientist, Center for Public Health and Environmental Assessment

Nicolle Tulve discussed how soil and dust ingestion are important exposure pathways. ORD has received requests for better estimates of soil and dust ingestion rates for use in risk associated decisions. Fulfillment of the request requires the development of methods for collecting data which consider age, location, and season.

Bioavailability, Bioaccessibility, and Innovative Remediation Methods

Karen Bradham, Research Physical Scientist, Center for Environmental Measurement and Modeling

Matt Lambert, Environmental Scientist, Office of Superfund Remediation and Technology Innovation

Karen Bradham presented on ORD's work to develop new technologies for remediation of contaminated soil.

Matt Lambert discussed how the Office of Superfund Remediation and Technology Innovation uses these technologies. ORD developed data set to evaluate *in vitro* Bioaccessibility (IVBA) and relative bioavailability (RBA) methods performance and assess potential uses of IVBA and RBA methods on other metals.

Assessment Tools for Heavy Metal Bioavailability in Soils and Sediments

Richard Devereux, Research Microbiologist, Center for Environmental Measurement and Modeling

Richard Devereux presented tools for assessing the bioavailability of heavy metal in soils. Research goals include development of fast, inexpensive methods to assess the bioavailability of lead and arsenic at contaminated sites.

Lead (Pb) Isotopes as a Tool for Source Appointment

Rick Wilkin, Senior Research Scientist, Center for Environmental Solutions and Emergency Response

Rick Wilkin presented the use of Pb isotopes as a tool for source appointment and improvement of site characterization.

- **Derek Shendell:** Is there a way to have a format (e.g., one-page/double sided) for case studies to be shared with stakeholders?
    - **Rick Wilkin:** One of the document formats that we have is Science in Action. The point of the case studies is to have something that is readily available.
    - **Jonathan Meiman:** In Wisconsin, we have been dipping our toes into this work. **Rick Wilkin:** we have been challenged to examine geese in a mining impacted area–feces, soil, and avian blood.

BOSC Subcommittee Discussion and Questions and Answers

Courtney Flint, Chair

- **Rainer Lohman:** Can you do this at the response sites and the laboratories?
    - **Karen Bradham:** Iron-based salt solutions under heat and–takes the solubility out of the structure. We have only done this at the laboratory as we need heat (105 degrees) for this formation.
- **Kimberly Gray:** It seemed bioavailability was diminished by percentages. Was the decrease in bioavailability sufficient to? A 90 percent reduction seems sufficient, but reductions closer to 40 or 60 percent do not seem sufficient.
    - **Matt Lambert:** It depends on the Pb concentration and exposure (i.e., examining children or adult models). The amount of reduction needed is site-specific. Emergency response sites are a 90 percent reduction.
    - **Karen Bradham:** We found mineral jarosite–phosphate can release arsenic and bind Pb. We saw 95 percent reductions.
    - **Courtney Flint:** Is elimination of phosphorous part of a remediation strategy? Could this have unintended consequences?
        - **Karen Bradham:** We have done studies in California. We are doing work with EPA Region 10 and we do not see the same issue with jarosite.
- **Matthew Naud:** Many contaminated sites are not under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). How is ORD keeping track of this?
    - **Karen Bradham:** We work with the Interstate Technology and Regulatory Council (ITRC) to develop guidance and training for these methods (*in vivo* mouse model and 1340 method).
- **Derek Shendell:** Do you have additional information on the seasonal variables on why fall would be different from spring and summer?
    - **Nicolle Tulve:** We are utilizing Consolidated Human Activity Database (CHAD) diaries for adults and children. Partly what we are seeing in the data is the pacifier-use scenario (e.g., at what age do they transition away from that object in their mouth). Pacifiers can be a vehicle for dust ingestion and carpet parameters are influencing the data in younger kids. In older kids, we are seeing hand-to-mouth parameters.
    - **Kimberly Gray:** It is incredible to see the hand-to-mouth data for children.

- **Courtney Flint:** The assumption of children's age with relationship to soil exposure is interesting. Thinking about cultural and regional variations, is this heterogeneity a future need?
- **Nicolle Tulve:** We are pushing the scientific envelop, especially where we are collaborating across the United States.
- **Kimberly Gray:** Certain foods can bioaccumulate Pb. Is EPA considering this?
- **Nicolle Tulve:** Our soil research is not considering any specific chemical.
- **Leslie Rubin:** Pb is very toxic to children, which is why I am concerned about this. I am excited to hear about the bacterial research. There is such variability of Pb in soil. Are you all working with groups on how to avoid Pb in produce gardens? Are you considering shooting ranges and Pb levels or mining sites and Pb levels?
- **Valeria Zartarian:** Regarding soil BLL hot spots, our team has been looking at different multimedia lead sources by looking at the literature and talking to regional office partners. I would be glad to share a paper about Pb associated with shooting ranges.
- **Karen Bradham:** We are working with groups, including Duke University and John Hopkins University, on community gardens.
- **Leslie Rubin:** Are there broader applications for this work as opposed to just community gardens?
- **Karen Bradham:** There could be broader applications. The U.S. Department of Housing and Urban Development (HUD) is also interested in applying this to broader residential sites and working to apply non-toxic practices for gardeners and homeowners.
- **Tom Holdsworth:** There was a link posted yesterday about eastern mining and it related to exposure to lead and other metals.
- **Alan Walts:** Until we have additional data, we are using hot spot analysis to assess where we need to answer these questions.
- **Kimberly Gray:** There was a fair amount of work done looking at gardening and there was a suggested of raised-bed gardening. You have to make sure there is not a continued source of lead.
- **Karen Bradham:** Our regional offices have been working on educating about raised bed gardening.
- **Kimberly Gray:** It would have been nice to see maps and papers on this. How are hot spots defined and did you look at Pb levels in soil?
- **Valeria Zartarian:** We looked at BLL data where available, in states where that data was not available, we used surrogates. We found that old housing data helped to explain some 'hot spots' but not all locations.

- **Elena Irwin:** The extent to which it works is trying to identify causal mechanisms of older homes would lead to elevated BLLs. It is difficult because there are many correlations as to why health effects could be correlated but not causal to the elevated

BLL. To what extent is the Agency trying to distinguish? There have been environmental economics. I would be glad to point you to papers about this issue. It would be interesting to see field designs on this.

  - **Lauren Wyatt:** I agree that addressing causality is tricky. We are focusing on addressing.
  - **Alan Walts:** We want to provide those natural experiments. If we can mobilize systemic interventions, I want to see how impactful that is. Isotopic analysis would be useful.

- **Jonathan Meiman:** What health impacts correlate on Pb service lines? It raises questions. We have had a hard time explaining what maps are telling us because that is what people want to know. There is a motivated community group saying that service lines are causing health issues where it could also be old housing. BLL data can be spotty across the United States.
  - **Valeria Zartarian:** We plan to work closely with our communications team to get messaging out.
  - **Alan Walts:** We want to focus on the most disproportionately affected communities, and we want to solve the issues we can with the tolls that we have. This is a conversation we want to set up and then convene partners to further discuss this issue.
- **Jonathan Meiman:** Have you talked with the Centers for Disease Control and Prevention (CDC) about getting a larger data set to work with? With COVID-19, we have found that CDC has realized it needs to share data.
  - **Valeria Zartarian:** We had conversations early on with CDC and we are working with Michigan on those indices.
- **Jim Kelly:** Minnesota would also be interested in participating. We do not have universal testing in Minnesota. As you get lower and lower in your definition of BLL, we know that although housing still contributes to elevated BLL so do non-environmental sources of PB becoming important (e.g., food and medicine)
  - **Alan Walts:** I would look forward to working with Minnesota. In terms of medicine and food sources, that is what I think is impactful about the disproportionate issues.
- **Mike Steinhoff:** Some of the outputs and databases–are those final products? What mechanisms exist to socialize those products to make people aware?
  - **Lauren Wyatt:** We are engaged in getting additional information from partners and we think databases could be most useful for our partners. Later, we can get papers out to others.
- **Rainer Lohman:** Did you surround any good tracers for candidates?
  - **Nicolle Tulve:** The five chemicals that we thought could be candidates after further review were found to not be viable candidates. I would suggest to non-targeted analysis.

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Tom Holdsworth noted the engineering issues paper that is on SharePoint as background information. Tom Holdsworth and Courtney Flint concluded the meeting by sharing their appreciation for the contributions of the Subcommittee.

Adjourn

The meeting adjourned at 5:00 p.m., Eastern Time

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Thursday, April 1, 2021

Welcome – Day 3

The meeting reconvened at approximately 11:00 a.m., Eastern Time.

BOSC Subcommittee Chair Opening Remarks

Courtney Flint, Chair

There are unconventional sources on EPA's radar, including industrial sources brought up from building excavation. The Office of Air and Radiation (OAR) began its revision of integrated science assessment. One of the new sources being considered is aviation fuel. Pb is also found in drinking water and food supply.

Tom Holdsworth confirmed that drinking water-related issues are not in the purview of this subcommittee.

Public Comments

Tom Tracy, Designated Federal Officer, Office of Science Advisor, Policy, and Engagement

No public comments were received.

Technical Support and Impact to Research Implementation

Charles Maurice, Environmental Scientist, Sustainable and Healthy Communities Research Program

Diana Cutt, Superfund Technology Liaison/ Hydrogeologist, Center for Environmental Solutions and Emergency Response

Felicia Barnett, Environmental Engineer, Center for Environmental Solutions and Emergency Response

Dan Powell, Chief, Technology Integration and Information Branch, Superfund Program

Charles Maurice introduced the final session which is focused on technical support. There are five technical support.

Diana Cutt presented an overview of ORD Technical Support at mining and mineral processing sites. Technical support involves evaluating sources and background concentrations, contaminant fate and transport, and analysis and remediation approaches. She explained the impacts of technical support including assisting in defining the extent of site related contamination using cost effective measures and using innovation in remediation approaches to eliminate or reduce exposures to contaminants from mining sites.

Diana Cutt discussed technical support at Pb impacted sites, which involves evaluating sources and background concentrations, technology transfers, and remediation approaches. She also explained ORD technical support for solvent vapor intrusion and LUST.

Felicia Barnett described mining technical support that ORD provided at Bonita Peak, Colorado, and she shared results from the efforts and related impacts. She also shared an example of

ORD's technical support for leaking underground storage tanks at Davis Chevrolet, Arizona. She shared key takeaways highlighting ORD's technical support impacts.

Daniel Powell presented the challenges of mining site cleanup. There is no overarching inventory of sites. There could be between 100,000 to 500,000 abandoned mine lands (AMLs). EPA's Office of Mountains, Deserts and Plains (OMDP) is focused on advocating and advancing cleanups at abandoned hardrock mining sites in the western United States.

BOSC Subcommittee Discussion and Questions and Answers

Courtney Flint, Chair

- **Jay Golden:** Given that it is a new program, is there a program implementation plan outlining priorities, goals, and metrics for evaluations?
    - **Dan Powell:** EPA learns from state agencies efforts, including innovative approaches. ITRC and Association of States and Territorial Solid Waste Management Officials (ASTSWMO).
    - **Jay Golden:** Given that it is a new program, is there a program implementation plan outlining priorities and goals and metrics for evaluations?
    - **Dan Powell:** We plan to incorporate feedback and stakeholder response throughout the program. This is a lean program. OMDP was initially set up to support EPA Regions 6, 7, 8, 9, and 10.
    - **Courtney Flint:** Some of these topics OMDP is working on could be related to SHC's Remediation to Restoration to Revitalization (R2R2R) effort.
    - **Tom Holdsworth:** R2R2R is focused on sediments. I would anticipate R2R2R stepping into the mining space as EPA develops its next Strategic Plan.
    - **Courtney Flint:** Is the lack inventory of mining sites something that SHC could help support?
    - **Tom Holdsworth:** Much of our research begins with a literature search. We should begin considering with OLEM and OMDP what issues are the most critical to prioritize. We have the expertise to begin the literature search for the inventory, and ORD would not do this alone.
    - **Dan Powell:** There are varying levels of inventories that have been completed in past EPA efforts, so we should strive to have a comprehensive picture.
- **Leslie Rubin:** With respect to remediation and reuse of the properties and Brownfield sites, do you work collaboratively to get reuse for these sites?
    - **Dan Powell:** Within EPA there are different waste programs. Our office focuses on sites that are mining and west of Mississippi River.
    - **Tom Holdsworth:** OMDP is not set up for this.
    - **Leslie Rubin:** Is there a way to work with people who profited from these mines to help?
    - **Tom Holdsworth:** ORD cannot direct Congress to change the approach of how ORD receives its funding.

  - **Dan Powell:** Sites in the Superfund realm are diverse. For abandoned sites, there are no viable responsible parties.
  - **Felicia Barnett:** If responsible parties are available, we have more with mine processing facilities. EPA is seeking to involve organizations. We are doing cost recovery work to identify responsible parties.
  - **Courtney Flint:** Good Samaritan efforts include volunteer organizations that would seek to support ecological improvements.
  - **Dan Powell:** We would want to advance the applicability of these volunteer efforts.
  - **Leslie Rubin:** Tribal communities and environmental justice issues are important.
- **Charles Maurice:** There are many ecosystem services and revitalization that lend themselves to be transferred over to mines. Ecological concerns and impacts are substantial. Communities and human populations can benefit from the ecological
  - **Dan:** OBDP focuses on tribal needs and understanding what is important to those communities.
- **Derek Shendell:** Could you comment on the potential for EPA to move forward to collaborate with the U.S. Department of the Interior (DOI) and how do you handle when a watershed crosses state boundaries?
  - **Tom Holdsworth:** We bring in our partners including DOI, U.S. Geological Survey (USGS), and the U.S. Forest Service. When we invite someone to partner with us, we ask for commitment to avoid drop out of interest–barrier is that agencies do not always have the time. Environmental services in many agencies are understaffed.
  - **Dan Powell:** We try to improve the dialogue amongst agencies and different programs across EPA.
  - **Tom Holdsworth:** It is also difficult when a watershed or plume crosses different communities, which could have different opinions. Environmental justice becomes an issue.
  - **Charles Maurice:** Regional staff and related programmatic staff connect with the correct parties for the correct jurisdiction.
  - **Tom Holdsworth:** Shared an example of Montana and Canada and EPA is continuing to work on this.
  - **Charles Maurice:** EPA Region 5 and Region 2 work with Canada a lot.
- **Robert Weber:** Much of this revolves around effective communication. Many of these large mining sites require stakeholder coordination groups, which are important.
- **Derek Shendell:** I appreciate the work

BOSC Breakout Discussions

Matthew Naud discussed the goals of breakout groups.

BOSC Report Out

Charge Question 1

Dr. Jay Golden discussed the strengths, suggestions, and recommendations for Charge Question 1. There are two possible recommendations: to develop an inventory of active, stand-by and closed hardrock mining sites in the United States and to develop an inventory of mine waste technologies.

Dr. Courtney Flint stated that these inventories could help both parts of the charge question. It could possibly help with the applicability of the science and for the technology transfer.

- **Lucinda Johnson:** I work in the mining space in Minnesota with development of remediation technologies for sulfate reduction. I am familiar with the SME meetings. Are there potential short-term benefits to developing special symposia at on-going conferences that address hardrock mining activities that might kick in before the 2023 timeframe envisioned for the conferences? How is the planned conference offering something unique that is not part of on-going conferences offered nationally or internationally?
    - **Jay Golden:** There are several opportunities within our suggestions. I can send you those conferences. There are several industries and academia that come together for these conferences. I think there is a space for individuals in the technology. The view that if EPA is the host will result in hesitancy to attend is a false narrative. Industry believes that EPA has technical expertise and credibility for individuals to come and present ideas. I would leverage EPA and ORD names to attract people.
- **Tom Holdsworth:** I think the comments here are positive. The possible recommendations are actionable. We can take them under advisement and plan to implement them.
- **Rainer Lohman:** Connecting with the office of mountains, states, and others would also be important.

Charge Question 2

Rainer Lohman discussed the strengths, suggestions, and recommendations for Charge Question 2. Mike Steinhoff emphasized that the group hopes to get comment from EPA about facilitating cleanup. Elene Irwin added that the group discussed overarching themes and suggestions. The suggestion about renewed and expanded focus on environmental justice, it is important to work on all different angles of this.

- **Tom Holdsworth:** The UST Finder, what was demonstrated to you, you saw version 1. For version 2, we will take these ideas into advisement. Some of the innovative technologies, I would appreciate the comments and we will respond to this. I appreciate the linkage between the UST Finder and EnviroAtlas and we will investigate this.

- **Leslie Rubin:** I appreciate your inclusion on the environmental justice issues. Do you have specific focus on tribal groups, or is it generally inclusive?
    - **Elena Irwin:** We did not have anything specific to tribal groups. There could be environmental justice issues rising with the potential for gas stations to be closing.

Charge Question 3

Barrett Ristroph discussed the strengths, suggestions, and recommendations for Charge Question 3.

- **Tom Holdsworth:** I appreciate these comments and I look forward to addressing and incorporating the recommendations.
- **Jennifer Cashdollar:** This work falls under a research area that I coordinate, and I think these are good suggestions.

Charge Question 4

Derek Shendell discussed the strengths, suggestions, and recommendations for Charge Question 4. There are several strengths that bridge both research areas. There was a clarifying question about specificity of the definition and context about hotspots.

- **Tom Holdsworth:** There are no concerns for this. I appreciate the mention about blood lead level and the suggestion and coordination with the scientists.
- **Jennifer Cashdollar:** These were good suggestions and recommendations. The recommendation about risk communication activities is something we are working with our regional partners on. The communication activity is something that we must work with regional partners, and they must work with the states on.

Dr. Courtney Flint discussed next steps for the group.

Adjourn

The meeting adjourned at 2:30 p.m., Eastern Time.

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Friday, April 16, 2021

Welcome – Day 4

The meeting reconvened at approximately 11:00 a.m., Eastern Time.

Andrew Geller thanked the participants for their input and interactions. He discussed an effort to allow SHC and ORD scientists to have more collaborative discussions. As SHC and ORD go forward, the importance of environmental justice is strongly emphasized.

Courtney Flint discussed the on-going work for the charge questions. She detailed the purpose of the meeting to continue working on the charge questions and present recommendations.

Discussion of Charge Question 4

- Derek Shendell gave an overview of the question narrative. The breakout group's question covered Research Areas 2 and 5 but the focus of the discussion was Research Area 5. He read the recommendations and discussed how their group split the suggestions into multiple sections.
- **Leslie Rubin:** I think poverty or low-income communities should be included as well.
    - **Derek Shendell:** We were under the impression that in the suggestion's bullets, we were highlighting what there was no data available for.
    - **Leslie Rubin:** There is some addressing of those populations in Research Area 4 and 5.
- **Andrew Geller:** In terms of benefits and costs analysis, the formal economic analyses are done with agency partners.

Discussion of Charge Question 1

Jay Golden discussed the suggestions for Charge Question 1. The breakout group discussed how further research engagement is critical with industry partners. The group identified a need for more robust inventories for sites and technologies.

- **Derek Shendell:** Are we able to integrate EJSCREEN?
    - **Courtney Flint:** Yes, that is correct.

Discussion of Charge Question 2

Mike Steinhoff reiterated the strengths for Charge Question 2. He then summarized the suggestions made by the breakout group including the integration of EPA tools, expanding UST Finder training, and expanding UST Finder with spatial analysis capabilities. He discussed overarching suggestions including environmental justice and interdisciplinarity.

- **Matthew Naud:** Is it ORD's role to create some of these case studies that push down to the regions?
    - **Andrew Geller:** The presentations on the UST Finder are on its primary release and it will continue to be developed.

- **Thomas Holdsworth:** The first training on UST Finder was in December 2020, as we move forward, we will take suggestions to make UST Finder more useful. As for case studies, the issues are FTE and budget. We work in tandem with ORD.

Discussion of Charge Question 3

Barret Ristroph presented the strengths for the research approach for Charge Question 3. She mentioned the importance of environmental justice and outreach that was identified by the breakout group. She presented the research suggestions that the group proposed, including prioritization of basic science development, capturing climate and temporal variability, and an effort to develop transferable methods and guidance. One of the suggestions highlighted by group discussion was a national registry related to UST Finder that would inventory potential vapor intrusion sources.

- **Andrew Geller:** I am intrigued by the idea of a registry; it is something that we must explore with our agency partners.
- **Leslie Rubin:** I think Barret Ristroph mentioned measuring impact of vapor intrusions and some consequence. Are there any more comments or thoughts on that?
  - **Thomas Holdsworth:** I can't speak for EPA, but we have been trying to assess impact for homeowners and communities.
- **Rainer Lohmann:** This goes back to my question from March 31st following Henry Schuver's presentation. Regarding building a home with all the sensors needed and they would be needed. It came up as a pipedream, however if it is required, then it should be reclassified as an instrument to justify the cost.

BOSC Subcommittee Discussion

Courtney Flint presented the list of crosscutting themes that will be highlighted in the report. The themes included environmental justice, climate change, integrations of tools, and outreach efforts.

- **Leslie Rubin:** I want to mention in this list the importance of impact measurement and cost-benefit analysis. It can be meshed into any of the themes or included as its own theme.

Adjourn

The meeting adjourned at 4:00 p.m., Eastern Time.

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Appendix A: Agenda

United States Environmental Protection Agency
Board of Scientific Counselors (BOSC)
Sustainable and Healthy Communities (SHC)
Meeting Agenda
March 30–April 1, 2021
Virtual

Day 1: Tuesday, March 30, 2021, Eastern Daylight Time

TIME (ET)	AGENDA ACTIVITY	PRESENTER
Day 1: Focus on Mine Waste and Underground Storage Tanks Research Implementation		
10:45 – 11:00	Sign on and Technology check	
11:00 – 11:10	Meeting Kickoff/FACA Rules/expectations/logistics	Tom Tracy, DFO, OSAPE
11:10 – 11:20	Welcome	Chris Frey, ORD, DAA for Science Policy Jennifer Orme-Zavaleta, ORD Principal DAA for Science
11:20 – 11:30	Subcommittee Chair Opening Remarks and Introductions	Courtney Flint, Chair
11:30 – 11:40	SHC Opening Comments	Andrew Geller, Acting NPD, SHC
11:40 – 11:50	Research Implementation Approach between ORD and OLEM	Carlton Waterhouse, OLEM, Deputy Assistant Administrator
11:50 – 12:10	**Break–return with lunch**	
12:10 – 12:20	Implementation of Mining and Underground Storage Tank Research in CESER	Greg Sayles, CD, CESER
Charge Question 1: Treatment and Control of Mining Wastes Greg Sayles		
12:20 – 2:20	Geochemical Characterization of Acid Mine Drainage	Richard Wilkin, CESER
	Evaluation of a Permeable Reactive Barrier for Treatment of Acidity and Heavy Metals in Groundwater	Ralph Ludwig, CESER
	Isolation of Mine Waste Field Pilot	Ed Barth, CESER
	10-Minute Break	
	Soil Amendment Technologies to Stabilize Mercury	Todd Luxton, CESER
	Hardrock Mining Remediation Challenges and Treatment Technologies	Barbara Butler, CESER Ian Bowen, R8
2:20 – 2:50	BOSC Subcommittee Discussion and Qs/As	Courtney Flint, Chair

2:50 – 3:00	Break	
Charge Question 2: Underground Storage Tanks Thomas Holdsworth		
3:00 – 5:00	UST Web Application V1.0 and V2.0	Alexander Hall, CESER
	National Assessment of Fluvial and Coastal Flooding on Tanks Infrastructure and Groundwater Vulnerability Model	Alexander Hall, CESER
	Diving Ground Water Plume Application	Ralph Ludwig, CESER
	10-Minute Break	
	Identify Corrosion Processes Occurring in Underground Storage Tank Systems Based on Infrastructure and Fuel Type	Fran Kremer, CESER
	Identify Methods to Assess Corrosion Processes Based on Tank Infrastructure and Fuel Type	Fran Kremer, CESER Mark Barolo, OUST
5:00 – 5:30	BOSC Subcommittee Discussion and Qs/As	Courtney Flint, Chair
5:30	Wrap-up Day 1	Courtney Flint, Chair

Day 2: Wednesday, March 31, 2021, Eastern Daylight Time

TIME (ET)	AGENDA ACTIVITY	PRESENTER
Day 2: Focus on Solvent Vapor Intrusion and Lead Research Implementation		
10:45 – 11:00 AM	Sign on and Technology check	
11:00 – 11:05	BOSC Subcommittee Chair Opening Remarks	Courtney Flint, Chair
11:05 – 11:15	Public Comments	Tom Tracy, DFO, OSAPE
11:15 – 11:25	Implementation of SVI and Lead Research in CEMM	Tim Watkins, CD, CEMM
Charge Question 3: Solvent Vapor Intrusion Tim Watkins		
11:25 – 1:00	Characterize Vapor Intrusion in Large Multi-component Buildings	Brian Schumacher, CEMM
	10-Minute Break	
	Field Testing and Data to Update Guidance on Subslab Sampling of Soil Gas	Brian Schumacher, CEMM
	Data Models of Temporal and Spatial Variability in Vapor Intrusion	Brian Schumacher, CEMM Henry Schuver, OLEM
1:00 – 1:30	BOSC Subcommittee Discussion and Qs/As	Courtney Flint, Chair

1:30 – 1:50	Break	
Charge Question 4: Chemicals of Immediate Concern (Lead) Jennifer Cashdollar		
1:50 – 4:00	Collaborative Science-Based Approaches and Results to Identify High Lead (Pb) Exposure Locations in the U.S. and Key Drivers at those Locations	Valerie Zartarian, CPHEA and Alan Walts, R5, OECA
	Health Effects of Changing Lead Exposures and Community Factors Which May Alter Potential Health Benefits	Lauren Wyatt, CPHEA
	10-Minute Break	
	Methods and approaches to improve accuracy, reliability, and confidence of children's soil and dust ingestion rates	Nicolle Tulve, CPHEA
	Bioavailability, Bioaccessibility and Innovative Remediation Methods	Karen Bradham, CEMM and Matt Lambert, OSRTI
	Assessment tools for heavy metal bioavailabiliity in soils and sediments	Richard Devereux, CEMM
	Pb isotopes as a tool for source apportionment	Rick Wilkin, CESER
4:00-4:30	BOSC Subcommittee Discussion and Qs/As	Courtney Flint, Chair
4:30	Wrap up Day 2	Courtney Flint, Chair

Day 3: Thursday, April 1, 2021, Eastern Daylight Time

TIME (ET)	AGENDA ACTIVITY	PRESENTER
Day 3: Focus on Technical Support and BOSC Deliberation April 1, 2021		
10:45 – 11:00	Sign on and Technology Check	
11:00 – 11:05	BOSC Subcommittee Chair Opening Remarks	Courtney Flint, Chair
11:05 – 11:15	Public Comments	Tom Tracy, DFO, OSAPE
SHC Session 5: Technical Support Charles Maurice		
11:15 – 12:15	Technical Support and Impact to Research Implementation	Charles Maurice, SHC Diana Cutt, CESER Felicia Barnett, CESER Dan Powell, OMDP

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12:15 – 12:30	BOSC Subcommittee Discussion Qs/As	Courtney Flint, Chair
	10-Minute Break (and lunch break, as determined by BOSC SC)	
12:30 – 2:00	BOSC Breakout Discussions	SHC BOSC SC
2:00 – 2:30	BOSC Report Out and Adjourn	Courtney Flint, Chair Andrew Geller, Acting NPD, SHC

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Appendix B: Participants

BOSC Subcommittee Members:

Courtney Flint
Matthew Naud
Jay Golden*
Kimberly Gray
Elena Irwin
James Kelly
Rainer Lohmann
Jonathan Meiman
Donald Nelson
Barrett Ristroph
Leslie Rubin
Derek Shendell
Michael Steinhoff

**Did not attend on March 31, 2021*

EPA Designated Federal Officer (DFO): *Tom Tracy, Office of Science Advisor, Policy, and Engagement*

Presenters:

Felicia Barnett, *Environmental Engineer, Center for Environmental Solutions and Emergency Response*
Mark Barolo, *Acting Director, Office of Underground Storage Tanks*
Ed Barth, *Senior Researcher, Center for Environmental Solutions and Emergency Response*
Ian Bowen, *Geologist, EPA Region 8*
Karen Bradham, *Research Physical Scientist, Center for Environmental Measurement and Modeling*
Barbara Butler, *Environmental Engineer, Center for Environmental Solutions and Emergency Response*
Diana Cutt, *Superfund Technology Liaison/ Hydrogeologist, Center for Environmental Solutions and Emergency Response*
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