DRAFT

U.S. Environmental Protection Agency Board of Scientific Counselors

Safe and Sustainable Water Resources Research Program

Virtual Meeting Minutes

May 26-27, June 22, and June 29, 2021

Dates and Times: May 26, 2021, 12:00 to 5:30 p.m.; May 27, 2021, 12:00 to 5:30 p.m.; June 22, 2021, 11:00 a.m. to 2:00 p.m.; June 29, 2021, 11:00 a.m. to 2:00 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.

Contents

DRAFT

Wednesday, May 26, 2021

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

Welcome and Opening Remarks

Tom Tracy, Designated Federal Officer, Office of Science Advisor, Policy, and Engagement
Joseph Rodricks, Chair, Safe and Sustainable Water Resources Subcommittee
Robert Blanz, Vice Chair, Safe and Sustainable Water Resources Subcommittee

The meeting convened at approximately 12:00 p.m. Eastern Time. Mr. Tom Tracy, Designated Federal Officer (DFO) for the U.S. Environmental Protection Agency (EPA) Board of Scientific Counselors (BOSC) Safe and Sustainable Water Resources (SSWR) subcommittee, thanked the members for their attendance. He made brief announcements regarding virtual meeting capabilities and reminders. He shared that there were no public comments, and he said BOSC SSWR subcommittee members had no conflicts of interest.

Dr. Joseph Rodricks, Chair, SSWR Subcommittee, welcomed all participants to the meeting and thanked them for joining. He mentioned that the subcommittee meetings would hopefully transition to in-person soon. The BOSC SSWR subcommittee members, DFO, and EPA staff members introduced themselves.

Office of Research and Development Welcome

Bruce Rodan, Associate Director for Science, Office of Research and Development

Dr. Bruce Rodan, Associate Director for Science, Office of Research and Development (ORD) welcomed attendees and extended a thanks from ORD for the subcommittee's review in 2020 of the watershed research topic. He discussed that ORD would now receive feedback on the water treatment infrastructure research topic. Dr. Rodan noted that members would hear from ORD scientists who implement research on the drinking water treatment and distribution system centers, technical support, wastewater reuse, and stormwater management. He thanked the subcommittee members for accommodating and continuing to work with EPA through virtual meetings. He emphasized Dr. Rodricks' previous comment on in-person meetings, stressing that EPA is waiting on guidance regarding in-person meetings.

Dr. Rodan concluded with explaining Coronavirus Disease 2019 (COVID-19) changes for ORD. He noted that EPA activities on COVID-19 had been interesting, such as evaluating environmental clean-up and disinfection techniques. He noted ORD's work on SARS-CoV-2 surveillance in wastewater systems. He stated that ORD looks forward to hearing the subcommittee's input and feedback on the work being conducted under the SSWR Research Program.

DRAFT

Safe and Sustainable Water Resources Research Program Overview and Charge Questions
Suzanne van Drunick, National Program Director, Safe and Sustainable Water Resources Research Program

Dr. Suzanne van Drunick, National Program Director, SSWR Research Program, thanked the subcommittee for their input on the watershed research topic. She provided a brief overview of the charge questions and mentioned that they would discuss in greater detail after the presentations.

Dr. van Drunick explained that Charge Question 1 is on drinking water and distribution systems, where research is primarily focused on lead and copper control, disinfection by-products (DBPs), and opportunistic pathogens. She noted that many of these challenges show higher prevalence in disadvantaged communities. The question posed to the subcommittee asked for their suggestions and recommendations on the implementation of its drinking-water and distribution center, and particularly how these research activities can be comprehensively integrated to ensure safety in these distribution systems, while minimizing exposure to lead, DBPs, and opportunistic pathogens in disadvantaged communities.

Dr. van Drunick explained that Research Area 8 is on per- and polyfluoroalkyl substances (PFAS), but because the BOSC Executive Committee will review the PFAS work across ORD, they did not include a charge question on PFAS for this meeting. The second charge question is on wastewater and water reuse, where ORD found its niche to not duplicate other research efforts, specifically focused on small municipal water systems and non-municipal sources of wastewater (e.g., industrial and agricultural). She questioned how this can be a solution for changes in climate patterns, where there is increased frequency, intensity, and duration of prolonged heat events and drought, and meet the disconnect of water availability and water demand. She then asked for suggestions to innovatively augment water supplies.

Dr. van Drunick discussed that Charge Question 3 focuses on stormwater management, where stormwater is viewed as a resource. ORD's focus is to decrease runoff to wastewater systems and to prevent combined sewer system overflows, emphasizing environmental justice. The charge question asks the subcommittee what recommendations they must improve the utility of stormwater management research and integrate support tools for disadvantaged communities.

Office of Research and Development Center and Grants Overview
Greg Sayles, Director, Center for Environmental Solutions and Emergency Response
Rusty Thomas, Director, Center for Computational Toxicology and Exposure
Mary Ross, Director, Office of Science Advisor, Policy, and Engagement

Dr. Greg Sayles, Director, Center for Environmental Solutions and Emergency Response (CESER), explained the work of CESER, emphasizing that their mission is to work on environmental solutions to problems with a focus on the built environment. He explained that

CESER works on stakeholder-driven research and provides technical support. CESER specifically provides technical support on water distribution across the nation.

Dr. Sayles explained that CESER works on SSWR program priorities and more broadly on contaminated site cleanup, homeland security and emergency response research, sustainable materials management, development of analytical methods, packaging of user-friendly decision support tools, and providing technical support across the country.

CESER's work supporting the SSWR program is headquartered in Cincinnati, Ohio. Dr. Sayles noted that CESER works closely with state water utilities to help define research product priorities and work with them as they are developed and disseminated. He compared the various meeting topics to CESER's work on opportunistic pathogens in drinking water systems, chemical and microbial methods development, lead in distribution systems, small systems technologies, and infrastructure resilience to natural disasters.

To conclude, Dr. Sayles thanked everyone for their meeting preparations and upcoming recommendations and suggestions.

Dr. Rusty Thomas, Director, Center for Computational Toxicology and Exposure (CCTE) explained that CCTE's mission is to provide solutions-driven research to rapidly evaluate potential human health and environmental risks and ensure the integrity of the freshwater environment. In addition, Dr. Thomas discussed CCTE future research goals.

CCTE involvement with the SSWR program is multi-faceted. The Center has a 90-ft research vessel, aquatic exposure testing facilities, and develops and evaluates in-vitro and in-vivo chemical assays. Dr. Thomas highlighted that CCTE is heavily involved in Research Area 7 of the SSWR program. CCTE aims to decrease the uncertainty in regulatory decision-making surrounding DBPs. In addition to Research Area 7, CCTE is involved in Research Area 9, focusing on involvement in wastewater and water reuse to assess the contaminants in wastewater and stormwater. He concluded with thanking everyone for their service to ORD.

Dr. Mary Ross, Director, Office of Science Advisor, Policy, and Engagement (OSAPE) provided an overview of OSAPE and its mission on presenting extramural research. OSAPE has a range of functions, where their mission is in line with ORD and EPA to provide scientific solutions and scientific decision-making. OSAPE runs EPA-wide programs on scientific rigor, integrity, human subjects review, managing BOSC, and scientific decision-making support for ORD.

Dr. Ross provided an overview of the SSWR program grants, including the Science to Achieve Results (STAR), National Priorities, and Water Technology. She discussed that OSAPE grants are focused on external researchers. Dr. Ross mentioned the upcoming grants and awards which are all posted on the OSAPE webpage.

Water Treatment and Infrastructure

Chris Impellitteri, Associate National Program Director, Safe and Sustainable Water Resources Research Program

Dr. Chris Impellitteri, Associate National Program Director, SSWR Research Program, noted that EPA's Office of Water (OW) standards and risk management division works on the rulemaking for PFAS and perfluorooctanoic acid (PFOA) in drinking water. He noted that because the Fifth Unregulated Contaminant Monitoring Rule is slated to start in 2023, the timing of this rule could be better. As mentioned previously, PFAS was not heavily discussed in the meeting because they will mention it in future meetings starting in August 2021.

Dr. Impellitteri discussed that contaminants of emerging concern is another issue of national importance. He noted that a national cross agency workgroup is working to develop a research plan that would address and meet the challenges raised by contaminants of emerging concern. He also mentioned DBPs as another area important to EPA.

Dr. Impellitteri went into greater detail discussing wastewater, where previous focuses were on the examination of wastewater to identify antibiotic-resistant bacteria hotspots. Unfortunately, the COVID-19 pandemic delayed those plans, leading to researchers shifting their work to COVID-19 water analysis. He asked if, moving forward, EPA could design more research on sewage monitoring and sewage research for other pathogens.

Another aspect of wastewater that Dr. Impellitteri raised was water reuse. EPA has a cross-agency effort to advance water reuse in the United States, specifically decentralized water reuse. These approaches have several benefits, including reusing resources and zero discharge.

Dr. Impellitteri lastly discussed stormwater management. Past research focused on stormwater at community levels, but because of climate change, these stormwater events have higher incidences. He mentioned that a future focus should be using stormwater as a resource, emphasizing its quality.

- **Joseph Rodricks:** You mentioned the words "integration of programs and research" several times. Is there integration-related research underway?
    - **Chris Impellitteri:** EPA is required by law to review existing regulations on a 6-year cycle, where one aspect I have been involved with is a 6-year review where OW did not simply pick one or two existing regulations to review, but they comprehensively reviewed several related actions at the same time. That is where our research should be heading. Currently, EPA examines long-term enhanced water treatment rules, disinfection issues, and Stage 1 and Stage 2 DBP reviews. Our research should review different strategies for effective disinfection, and we should have concurrent research that is going on with the possible consequences of that research.

- **John Lowenthal:** Similarly, has something happened in the treatment systems to warrant additional focus on the research area, or is this just proactive thinking?
    - **Chris Impellitteri:** Both. ORD is taking a more comprehensive and proactive approach for this research. DBPs research has also been particularly problematic warranting this additional focus.
    - **John Lowenthal:** If they are in exceedance, are they in exceedance leaving the treatment plant or is something happening in the distribution system that is causing it?
    - **Chris Impellitteri:** Something is happening in the distribution system.
- **John White:** Are people thinking about whether stormwater is going to be there to reuse, or are they just focusing on the water quality?
    - **Chris Impellitteri:** I think quantity is a huge aspect as well; does it make sense? We are examining this from a life cycle analysis prospective.
    - **Steve Carr:** I spent some time in the U.S. Virgin Islands, and a requirement there is that any home constructed must have a stormwater cistern. The new construction requirement is that you include underground storage tanks and use that water for irrigation. That could be one approach.
    - **Chris Impellitteri:** Yes, this is a concept of risk-based framework. We see the same extensive use in Puerto Rico.
- **Robert Blanz:** How is EPA generalizing saltwater intrusion issues?
    - **Chris Impellitteri:** Given a charge from Congress that was written into law that EPA was to work with the U.S. Geological Survey to develop best management practices for Stormwater and Enhanced Aquifer Recharge (EAR). There were no other caveats, but the implication was that it would enhance aquifer recharge for augmenting water supplies, not just for fighting saltwater intrusion.

Overview of Research Area 7: Drinking Water Treatment and Distribution Systems
Hale Thurston, Acting Center Director, Center for Environmental Solutions and Emergency Response

Dr. Impellitteri introduced Dr. Hale Thurston, Acting Center Director, CESER. Dr. Thurston welcomed everyone and greeted EPA partners. He provided a background on water systems, legacy issues, and other emerging issues. The topic area focuses to innovate and perfect cost-effective approaches to optimize drinking water approaches.

Dr. Thurston summarized Research Area 7's Agency driver, the Safe Drinking Water Act, where its focus areas include lead and copper, emerging contaminants, small systems, distribution systems, and premise plumbing. He noted that the fundamental reason for this research is to provide results to program offices, states, tribes, and communities to managing existing drinking water needs.

Dr. Thurston provided an overview of the four research outputs, and the presenters of each output. He discussed the research products which help provide stakeholders the tools to treat the increasingly limited and degraded drinking water to meet health-protective standards.

- **Steven Weisberg**: Where is EPA regarding microplastics in drinking water? Is it a part of your program, or how could it become a part of this program if it is not?
    - **Suzanne van Drunick**: That work is not in the present SSWR Strategic Research Action Plan (StRAP) because we first need a reliable reducible method to detect plastics in drinking water. EPA has discussed with other agencies to determine whose role is what relating to microplastics in drinking water.

Output 1: Resources and Tools for Characterizing and Mitigating Lead and Copper Release in Drinking Water Distribution Systems and Premise Plumbing

Darren Lytle, Engineer, Center for Environmental Solutions and Emergency Response

Dr. Darren Lytle, Engineer, CESER, presented an overview of Research Area 7, Output 1, which focuses on tools and resources for characterizing and mitigating lead and copper release in drinking water distribution systems and premise plumbing. He shared past examples of Flint, Michigan and Newark, New Jersey where it became clear that there was a need to reexamine treatment strategies to reduce lead in drinking water. The lead and copper rule was in the process of being revised, so there was a need to provide information for that process as well.

Dr. Lytle reviewed the lead and copper source characterization and assessment strategies, and mentioned EPA corrosion research, which helps better understand how these metals are released into and interact with drinking water. These analyses described the most helpful approaches and practices in improving corrosion control approaches and avoiding unintended consequences of source water and treatment change related to lead and copper release.

Dr. Lytle discussed lead and copper sampling and monitoring tools, and he described EPA efforts to sample for lead service line identification and exposure assessment. He shared how there are alternative approaches for sampling in addition to those that were presented, including water sampling strategies, and he explained how all products and approaches inform or can be directly used to link desired lead and copper questions with the proper water sampling approach.

The final aspect of Output 1 discussed is newly developed sampling for lead service line identification and exposure assessment, which helps develop inventories of what service materials are made of.

- **Joseph Rodricks:** Do more sources of variability complicate the decision-making process?
    - **Darren Lytle:** Lead release is variable within communities and even within an individual house. The more we review this, the more the variability has to do with particles, which seem to not be predictable.

- **Fred Hitzhusen:** How typical or atypical was the lead issue in Flint, Michigan? Is this limited to low-income communities?
    - **Darren Lytle:** The awareness prior to Flint, Michigan was not considered – moving forward from Flint, the industry makes strides to understand how to approach lead issues. Much of the problem has to do with communication.
    - **Steve Carr:** Is there likely a seasonal component?
    - **Darren Lytle:** Absolutely. Many things change seasonally. We should continue working to understand what aspects of seasonal change make these changes occur in lead or copper.

Output 2: Best practices, tools, and information for assessing and controlling pathogens and biostability in drinking water systems, managing disinfectant residuals, and minimizing DBPs
Eric Villegas, Microbiologist, Center for Environmental Measurement and Modeling

Dr. Eric Villegas, Microbiologist, Center for Environmental Measurement and Modeling (CEMM) discussed the research area, which focused on opportunistic pathogens, in addition to the microbiologic focus, where ORD is exploring the impacts of DBPs. He noted that this output had three themes, the first one being on tools development to better understand what is in the water distribution system, what opportunistic pathogens are present in that system, and understanding the microbial community. The second theme understands what variables are in the distribution systems and tries to address them. The final theme focuses on the health effects of the various opportunistic pathogens detected in the distribution systems.

He explained how CEMM works to understand the occurrence, prevalence, and control of *Legionella* throughout the drinking water system. He described ORD's efforts to understand what is in the distribution systems and how prevalent *Legionella* is throughout the United States. The goal of this research is to help inform the water utilities, states, and regions.

Dr. Villegas discussed the SSWR Research Program's Product 7.2.2, which focuses on the balance among having the right levels of disinfectant residuals and efficacious levels to control pathogen growth in the distribution system while preventing reformations. Scientists using this product aim to manage disinfectant residual and DBPs more effectively.

Dr. Villegas discussed the SSWR program's Product 7.2.3, which focuses on exposure and human health effects from drinking water pathogens found in distribution systems. He described how ORD scientists sought to understand the prevalence and incidences of opportunistic premise plumbing pathogen-associated disease burden in endemic regions, especially in underserved communities with inadequately treated water. He also discussed how environmental justice considerations are involved in the plans of this product.

- **Joseph Rodricks:** Are you considering models that explore the risks related to the pathogen and disinfectant itself or the DBPs, and finding the ideal situation for controlling these factors?
    - **Eric Villegas:** There are efforts to understand not only the dose levels that cause infection, but how the data generated from this product will plug into the model. I would assume that the developed models to assess the DBP levels in the previous product could certainly be useful in tweaking the model to have a more accurate assessment when it comes to disinfectant residuals.
- **Kate Lajtha:** Is there research to design more effective point-of-use devices that can handle different DBPs, or is that left to industry to do? Do you worry about the best point-of-use devices and systems?
    - **Eric Villegas:** I am a microbiologist, so I cannot necessarily address the engineering component.
    - **Chris Impellitteri:** The short answer is "yes." One of the extramural approaches is the EPA Small Business Innovation Research grants. We work with our contacts in OSAPE to develop small business innovation research grants that approach these exact issues.
    - **Darren Lytle:** I mentioned sampling devices. We use a research agreement with an outside organization that develops the media materials that go inside of the point-of-use devices. Although the focus is currently on the lead sampling device, we are having conversations about developing a material that removes lead but does not create an environment that microorganisms can grow.
    - **Chris Impellitteri:** We can work with private companies on an official level outside of the Agency. There are also internal mechanisms that we can use in our Agency agreements, where we can also collaborate with other federal agencies.
- **Robert Blanz**: How does the research address water and fire suppression systems disinfect in the water distribution systems?
    - **Chris Impellitteri:** We do not have any research that addresses fire suppression systems. However, the concept of identifying dead ends within the distribution system in premise plumbing is a challenge we are considering.
    - **Darren Lytle:** Stagnant water is the worst thing you could have regarding metal release entering water systems. Our OW colleagues have created documentation about these issues, and we are considering both microbial and water quality concerns.
- **Joseph Rodricks:** Could you please explain your comment regarding environmental justice issues?
    - **Shannon Griffin:** I work with underserved communities in Puerto Rico, and we consider this an environmental justice issue because, at last check, about one-third

of Puerto Rico's non-municipal drinking water systems offered little to no treatment at all. We are going into communities to explore baseline cases of disease and implementation of low-cost sustainable treatment technologies.

Output 3: Analytical methods, occurrence, health effects, and treatment assessments to aid regulatory decision-making

Jane Ellen Simmons, Chief of the Integrated Health Assessment Branch, Center for Public Health and Environmental Assessment

Dr. Jane Ellen Simmons, Chief of the Integrated Health Assessment Branch, Center for Public Health and Environmental Assessment (CPHEA) discussed Output 7.3, which involves analytical methods, occurrence, health effects, and treatment assessments to aid regulatory decision-making. She described Product 7.3.1 that consists of predictive computational tools to group and identify chemicals and determine joint toxicity and components driving risk to improve estimation. The anticipated impact of this product is to reduce bias and improve precision in estimation and modeling predictions.

Dr. Simmons also described Product 7.3.2, which aims to decrease uncertainty in regulatory decision-making. This product explores multi-route exposure of DBPs and develops information on integrated dosimetry models. The impact of this product is to provide OW with information to fill research gaps that prevent regulatory determination.

She also explained Product 7.3.3 that fills key knowledge gaps to support and enhance regulatory decisions for both chemical and microbial contaminants. She explained that there is no common organ for chemical and microbial contaminants. Product 7.3.3 provides a similar impact as Product 7.3.2, offering OW with updated information to fill any research gaps that prevent regulatory determinations and strengthen current rules.

- **Fred Hitzhusen:** What metrics do you use to quantify human health effects of various forms of contamination?
    - **Jane Ellen Simmons:** I am not qualified to answer. There is a line between research and policy. As a researcher, I need to let the data speak for itself. Within ORD, we work diligently to separate research from policy to avoid bias.
    - **Chris Impellitteri:** The short answer is that most of the economic benefits work is done in EPA's OW.

Output 4: Resources and tools toward a systems approach for maintaining drinking water infrastructure performance and integrity

Regan Murray, Director, Water Infrastructure Division, Center for Environmental Solutions and Emergency Response

Dr. Regan Murray, Director, Water Infrastructure Division (WID), CESER, discussed Output 4: Resources and tools toward a systems approach for maintaining drinking water infrastructure

performance and integrity. She shared SSWR Product 7.4.1, which focuses on water infrastructure and water quality models to improve water system performance and estimate exposure to contaminants. This product addresses the need to improve water quality and hydraulic models to support drinking water quality and infrastructure decision-making at the community, state, and regional level. She explained that the anticipated impact is to update systems analysis models, tools, and information for drinking water systems internationally to use in solving complex water quality and infrastructure issues.

Dr. Murray described the SSWR Research Program's Product 7.4.2 that uses treatment technologies to meet the needs of small systems in removing contaminants such as nitrates and manganese. This product impact is to develop approaches to use sustainably by small systems nationwide.

She also shared Product 7.4.3, which focuses on water distribution system integrity and performance research. She discussed a case study for the application of the Water Network Tool for Resilience (WNTR) and provided information on WNTR future plans including websites that will house data, tools, and information which will be made accessible to communities, states, and regions.

- **Jared Bales:** Are these models for internal ORD use or general use, and if so, how are they shared?
    - **Regan Murray:** All models I discussed are designed for use outside of the Agency and are available for free on EPA's website.
- **Fred Hitzhusen:** What is the implication of the importance of journal publications?
    - **Regan Murray:** We work closely with various partners, so the journal provides a peer review of our work and methodologies. Because our end users might not have interest in journal articles, we also share other information about our tools and models through our website.

Board of Scientific Counselors Discussion of Charge Question 1
Joseph Rodricks, Chair, Safe and Sustainable Water Resources Subcommittee
Robert Blanz, Vice Chair, Safe and Sustainable Water Resources Subcommittee

Dr. Rodan outlined the Biden Administration Executive Order on advancing racial equity and support for underserved communities through the federal government. The guiding policy of the Executive Order is to pursue a comprehensive approach to advancing equity for all including people of color and others who have been historically underserved, marginalized, and impacted by persistent poverty. It seeks fairness in addressing inequalities and sending federal goods and services to those most in need. From ORD's perspective, research and scientific information can be considered a federal service that is provided to the nation and to the communities most in need.

- **Robert Blanz:** How is an "underserved community" defined?
    - **Bruce Rodan:** We will have a list of definitions.
    - **Andrew Geller:** From EPA's Office of Management and Budget, these definitions are defined as populations sharing a particular characteristic and geographic communities who have been systematically denied a full opportunity to participate in aspects of economic, social, and civic life.
- **Elizabeth Fassman-Beck:** How can we disseminate the information in means other than journal articles?
    - **Bruce Rodan:** One aspect of the Executive Order is community science and empowerment. The first aspect of achieving the Executive Order will be defining barriers to communities having access to the full research capacity of the federal government. BOSC and ORD must coordinate and address these barriers that communities with environmental justice concerns face and what issues are important to them.
- **Fred Hitzhusen:** There is good research on the disproportionate impact of underserved communities downstream from hazardous waste sites. There is also good research on mining on native lands and their consequences. Does this mean you make sure these communities are served first, or does it mean something different than that?
    - **Bruce Rodan:** There are many aspects of this, where we must view things with different lenses. When we prioritize research, we must consider communities that are afflicted by stressors. We need to make sure we build trusting relationships with communities to allow us to have access to those communities and areas to help.
    - **Andrew Geller:** Part of these disparities is the recognition that environmental health risks are not equally distributed but are heterogenous and that there are some communities that are bearing more of the risk. Those who will be addressing those issues in communities across the country are EPA's program and regional offices. ORD's role is to supply the Agency with the scientific backing, technical support, and research.

Dr. Rodricks read Charge Question 1.

- **Joseph Rodricks:** What do you mean by implementation?
    - **Suzanne van Drunick:** For the user community, utilities, and small system operators, it is more about integrating the results. If you are a utilities operator, you want to ensure you have enough disinfectant in the system, so you do not have issues with opportunistic pathogens, but also do not want to have excess DBPs. How do you balance this?

- **Chris Impellitteri:** How do we get from journal articles to effective communication methods and useful resources so that these small systems in disadvantaged communities can implement improvements?

Dr. Thurston suggested setting up a sampling program that provides greater sensitivity to discuss imbalances that disadvantaged communities face. As an addition, Dr. Impellitteri discussed the Flint crisis to raise the idea of broadening research to ensure it includes lead and the distribution system at its entirety.

Dr. Rodan discussed that much of the research done under Charge Question 1 along with other SSWR program work has been in small systems. He believed that a focus on the implementation of systems and a balanced approach is needed for small and poor systems.

Overview of Research Area 11: Technical Support
Ben Packard, Biologist, Office of Science Advisor, Policy, and Engagement

Dr. Ben Packard, Biologist, OSAPE, provided an overview of SSWR Research Area 11: Technical Support. The goal of Research Area 11 is to provide timely extramural technical support and outreach to OW, regions, states, tribes, and communities needing help with drinking water, wastewater, stormwater, and water reuse challenges.

He discussed the distinct products of Research Area 11 which included site specific technical support, maintenance and training support for stormwater, wastewater, drinking water models, and small systems challenges and solutions.

Output 1: Technical support for water treatment, analytical methods, and risk assessments
Craig Patterson, Environmental Engineer, Office of Research and Development
Michelle Latham, Biologist, Office of Research and Development

Mr. Craig Patterson, Environmental Engineer, ORD, discussed Research Output 1, where he provided examples of ORD technical support such as corrosion control for lead, harmful algal blooms, emergency response, PFAS, and microbial contaminants. He highlighted that many of the technical requests ORD receives are largely unpredictable.

He outlined that issues with lead in drinking water require a lot of ORD technical support, where ORD assisted with lead particle size fractionation and identification in Newark, New Jersey. In addition, EPA supports COVID-19 detection in wastewater, ultimately improving these analytical detection methods and sharing them with communities around the world. EPA has developed web applications, models, and tools supported by other research areas, where Output 11.2 focuses on model maintenance and technical support for user requests.

Mr. Patterson explained how the EPANET model is used to understand and analyze the movement and fate of drinking water constituents within water distribution systems. ORD researchers created an open-source software project in collaboration with the EPANET user

community. Future plans include creating a Frequently Asked Questions page and updating the graphical user interface to include multiple chemical and biological species.

EPA's Storm Water Management Model (SWMM) is used to plan, analyze, and design stormwater runoff and combines with sanitary sewers and other drainage systems. ORD released two major SWMM upgrades with new features and had more than 40,000 downloads in FY2020. It is a strong stormwater tool; EPA is preparing future updates.

EPA's National Stormwater Calculator (SWC) is a tool to help control runoff and promote the natural movement of water. ORD plans future public deployment of an updated SWC web application.

EPA's Drinking Water Treatability Database (TDB) is a tool to provide treatability results and control of contaminants in drinking water from referenced information. The Water Treatment Plant (WTP) model assists utilities in achieving total system optimization to meet the required levels of disinfection while maintaining compliance. The Environmental Technologies Design Option Tool (ETDOT) provides the public with the means to evaluate and design systems that use granular activated carbon for the removal of contaminants from drinking water and wastewater. Lastly, EPA's Free Chlorine and Cyanuric Acid System (FCCAS) simulator models are web-based applications for simulations of various water chemistry conditions and water treatment in distribution systems.

Ms. Michelle Latham, Biologist, ORD, touched upon the products new eLearning for small systems. In addition, EPA has hosted workshops, monthly webinars, and technical communications workgroups including state representatives and water utilities.

The Annual Drinking Water Workshop has grown for the past 17 years to more than 500 attendees. Ms. Latham mentioned that this workshop provides a lot of in-depth training, including training on the models and tools. The 2020 workshop was virtual with attendance of more than 3,000 participants, and several tribal nations attended the workshop. She noted that recordings from the workshop were publicly available online and the 2021 workshop would also be virtual. Lastly, she stated that monthly webinar meetings were also available regarding small drinking water systems.

- **Elizabeth Fassman:** Are there any updates on the progress from National Academies of Sciences, Engineering, and Medicine?
    - **Ben Packard:** We are planning a progress review towards the end of 2021 through early 2022.
- **Steve Weisberg:** Do you plan to continue to help small systems and communities in the future?
    - **Chris Impellitteri:** We are at a junction where EPA and ORD try to plan for the future. Major challenges were public utilities, state level departments, and the

public health sector. There are some basic yet unanswered questions at the federal level, where federal agency roles are still being figured out.

Public Comment

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

Steve Via, American Water Works Association, provided public comments. He discussed that several of topics in research presentations are best handled when considered as a whole. Two points that were mentioned were if ORD is focused on the most important opportunities to improve public health for disadvantaged communities with distribution systems, a focus should be on the function of the facility and the connection to where someone lives.

- **Robert Blanz:** How would you quantify or characterize how your members apply the research ORD has done?
    - **Steve Via:** We use the research and specific tools every day. How ORD engages with our members and brings it back to policies influences our common understanding of the balancing factors in making decisions.
    - **Robert Blanz:** How about small systems work?
    - **Steve Via:** The work ORD has done on small systems helps us better understand treatment, and as the profession moves forward to make things work at the local level, ORD does a smart job of making on-site decisions.

Wrap Up

Joseph Rodricks, Chair, Safe and Sustainable Water Resources Subcommittee
Robert Blanz, Vice Chair, Safe and Sustainable Water Resources Subcommittee

Dr. Rodricks discussed the outline of the next meeting.

Adjourn

The meeting adjourned at 5:30 p.m. Eastern Time.

Thursday, May 27, 2021

Welcome – Day 2

Tom Tracy, Designated Federal Officer, Office of Science Advisor, Policy, and Engagement
Joseph Rodricks, Chair, Safe and Sustainable Water Resources Subcommittee
Robert Blanz, Vice Chair, Safe and Sustainable Water Resources Subcommittee

The meeting reconvened at approximately 12:00 p.m. Eastern Time. Dr. Rodricks provided an overview of the program and took attendance.

Office of Research and Development Centers Overview

Tim Watkins, Director, Center for Environmental Measurement and Modeling
Jamie Strong, Associate Director for Health and Ecology, Center for Public Health and Environmental Assessment

Dr. Tim Watkins, Director, Center for Environmental Measurement and Modeling (CEMM) presented an overview of CEMM and shared CEMM's research mission, which develops, evaluates, and applies measurements and models to characterize the sources, occurrence, transformation, transport, and effects of pollutants and stressors in the natural environment. He described how CEMM has six divisions with five geographical locations. Dr. Watkins discussed CEMM research in the SSWR program, and how CEMM conducts research in all three SSWR topic areas including watersheds, nutrients, and water treatment and infrastructure.

Dr. Jamie Strong, Associate Director for Health and Ecology, Center for Public Health and Environmental Assessment (CPHEA), presented an overview of and described CPHEA's mission and how it aligns with EPA's and ORD's visions. She described the products that CPHEA leads in the SSWR Research Program's water treatment and infrastructure research. Dr. Strong discussed CPHEA capabilities for water treatment and infrastructure, located at EPA's Pacific Ecological Systems Division in Corvallis, Oregon, and Public Health and Environmental Systems Division in Cincinnati, Ohio.

- **Elizabeth Fassman-Beck:** I heard research on-going with models, but not much about the systems themselves. Is there a dedicated coordination effort about how one group's work fits into another group's work?
    - **Tim Watkins:** With ORD's reorganization, there are increasing opportunities to make connections across ORD facilities and laboratories.
- **Joseph Rodricks:** Is there a list of all the water-related research efforts occurring throughout the Agency?
    - **Suzanne van Drunick:** Not all in one place. We could do a breakout by area and centers.
    - **Chris Impellitteri:** We go through a prioritization process. The links between non-targeted analysis and chemical analysis is coordinated in the Research Triangle Park, North Carolina facility.
- **Kate Lajtha:** Why are centers all on the East Coast of the United States, and one in Corvallis on the West Coast? It seems that some of that work is duplicative, so do those centers communicate?
    - **Tim Watkins:** We had four coastal ecology divisions that were in one area, within CEMM, and two divisions ended up in one of the centers and the pacific coast center ended up elsewhere. They are all in different national centers now, but they still work closely together.

Overview of Research Area 9: Wastewater and Water Reuse

Ann Grimm, Acting Center Director, Center for Environmental Measurement and Modeling

Dr. Ann Grimm, Acting Center Director, CEMM, presented an overview of Research Area 9, which focuses on wastewater and water reuse. She provided background information about how the microbial and chemical contaminants continue to be an issue for wastewater and water reuse treatment processes. She discussed how water reuse research will focus on fit-for-purpose applications for several sources and end uses. Dr. Grimm described the research outputs including Output 9.1: analytical methods, exposure, and effects assessment processes, and tools for wastewater and fit-for-purpose water reuse, and Output 9.2: treatment technologies for wastewater and fit-for-purpose water reuse.

Output 1: Analytical methods, exposure and effects assessment processes, and tools for wastewater and fit-for-purpose water reuse

Jay Garland, Associate Director, Center for Environmental Solutions and Emergency Response

Dr. Jay Garland, Associate Director, CESER, presented the SSWR Research Program's Product 9.1.1, which focuses on effects-based methods for assessing chemical contaminants in wastewater. He also shared the SSWR Research Program's Product 9.1.2, which quantifies microbial contaminants in wastewater and reclaimed water. He shared that the anticipated impact of this product is to provide stakeholders with information and tools for managing viruses and antimicrobial resistant bacteria and genes in wastewater treatment and collection systems and water reuse facilities. Dr. Garland then described Product 9.1.3, which identifies surrogates to monitor process performance in wastewater and reclaimed water. He shared that the intended impact is to equip utilities with resources to better monitor and manage treatment performance for removing pathogens and chemicals of emerging concern.

Output 2: Treatment technologies for wastewater and fit-for-purpose water reuse

Jay Garland, Associate Director, Center for Environmental Solutions and Emergency Response

Dr. Garland then discussed Research Output 9.2, which focuses on treatments assessments. He described the SSWR Research Program's Product 9.2.1, which develops risk-based guidance for fit-for-purpose treatment and reuse of wastewater. The impact for this product is to provide communities with frameworks to implement fit-for-purpose water reuse. Dr. Garland then reviewed Product 9.2.2, which optimizes water and water reuse treatment processes, and its impact is intended to provide stakeholders with additional innovative tools and resources for wastewater and water reuse treatment. He described the program's Product 9.2.3, which analyzes systems for alternative treatment approaches. The impact of this product is anticipated to provide communities with resources to aid decisions on alternative water management strategies and support National Water Reuse Action Plan (WRAP).

- **Joseph Rodricks:** What is the risk-based framework?

  - **Jay Garland:** You develop a risk-based framework of what you already know, and you then develop a treatment target to inform the acceptable parameters for using a particular water source.
- **Lucinda Johnson:** How much cross-communication is there between the SHC and SSWR programs when it comes to identification of fecal indicators?
  - **Jay Garland:** In this case, we are focused on treatment performance, not fecal indicators. It is about defining what the log reduction target needs to be.
- **Steve Carr:** Is the water reuse tool used to treat the volume of brine?
  - **Jay Garland:** Yes, it also examines brackish water and getting more water out of that brine.
- **Steve Weisberg:** What are you finding in the antibiotic resistance research? Where is your research heading?
  - **Jay Garland:** Future projections talk about antimicrobial resistance (AMR) being a major issue. There is the idea of examining AMR as a contaminant in wastewater and its potential release into the environment. As a public health tool, it can be used as an indicator of what emerges in the human population. Specifically on mitigation and removal, untreated wastewater is the greatest concern and risk. EPA's specific approach tries to understand is pretreatment something that makes sense.
- **Robert Blanz:** How is your research program dealing with the land application portion of water reuse?
  - **Jay Garland:** We are not. We examine the wastewater stream and answer, "to what extent must wastewater be treated for the water to be reused?"
  - **Chris Impellitteri:** Land application tends to be overlooked. PFAS brought biosolids to the forefront. We do have plans to increase our research portfolio in biosolids.
- **Fred Hitzhusen:** To what extent does the recharge of aquifers look promising, and to what extent do we get nutrient infusions in profiles for food production when we use biosolids?
  - **Jay Garland:** The nutrient value of biosolids is an important consideration. For example, if you consider incineration to minimize biosolids, you must also consider the impacts of nutrient reduction.

Board of Scientific Counselors Discussion of Charge Question 2
Joseph Rodricks, Chair, Safe and Sustainable Water Resources Subcommittee
Robert Blanz, Vice Chair, Safe and Sustainable Water Resources Subcommittee

Dr. White read aloud Charge Question 2.

- **John White:** What do you mean by agricultural wastewater?

  - **Jay Garland:** We are referring to the reuse of processing water.
  - **Robert Blanz:** It appears to be a holistic approach, and water reuse is very site-specific, so I am unsure where the research is headed in that direction.
  - **Suzanne van Drunick:** There has been a fair amount of work done with impaired groundwater and brackish water. There is a tremendous amount of water used in agricultural facilities where there are opportunities to tap into alternative water resources.
- **Jared Bales:** It is one thing if the question is about reuse, but if the question is about automatizing supplies and improving resiliency, that is an entirely other question. Should there be some focus simply on reducing water use in these agricultural facilities?
  - **Suzanne van Drunick:** The question is about listing promising alternative water sources. For example, rainwater treatment is inexpensive, but it is not always a reliable source.
  - **John White:** There is an obvious solution to reuse water within an agricultural facility. Aside from examining the quality, I do not know if you need research, but my understanding is that there has not been much treatment of the water that is used to wash areas within a facility.
  - **Fred Hitzhusen:** The issue is, how do you price water to make its reuse more feasible?
  - **John White:** Much of our good ground water goes to industries and not to drinking water sources.
  - **Jay Garland:** Research is needed to determine what the treatment requirements are.

Public Comment

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

No public comments were received.

Overview of Research Area 10: Stormwater Management

Ann Grimm, Acting Center Director, Center for Environmental Measurement and Modeling

Dr. Grimm discussed how stormwater management continues to be a challenging component for communities throughout the United States. CEMM's goal is to integrate infrastructure to measure stormwater effects on human health and the environment.

She mentioned that Research Area 10's goal is to explore the impact, opportunities, and infrastructure and understand how EPA can better manage stormwater flow to reduce impacts. Research Area 10 produces tools and methods that OW and communities can use to better manage stormwater.

Dr. Grimm provided an overview of the research outputs. Charge Question 1 focuses on Output 10.1: planning, implementing, and monitoring stormwater practices. The second output is Output 10.2: stormwater management as a resource for enhanced recharge, capture, and use. She noted that the research products are the concrete deliverables; they are the pieces that ORD produces to provide stakeholders with management and monitoring strategies.

Output 2: Stormwater Management as a Resource for Enhanced Recharge, Capture, and Use
John Johnston, Chief of Landscape and Aquatic Systems Modeling Branch, Center for Environmental Measurement and Modeling

Dr. John Johnston, Chief of Landscape and Aquatic Systems Modeling Branch, CEMM, discussed that in Output 2, EPA recognized that as climate change and storm intensity and magnitudes increase, municipalities have limited resources, so EPA has a range of options for them to choose from.

He explained that a large part of research in Output 10.2 is field research. This uses stormwater as a potential resource rather than conveying it off site, exploring the use of EAR. The results discussed the cost-benefits of recharge through enhanced management of the source. The impact of Output 10.2 was that it recharges aquifers by providing stakeholders with stormwater best management practices.

The recommendations for capture and on-site use, Product 10.2.2, was in collaboration with Product 9.2.1. Dr. Johnston explained that EPA needs to understand the sources, pathways, and exposures for these capture methods. Whether it is pathogens or metals, EPA should understand what drives the human health risk. This will provide communities with results and best practices for implementing stormwater capture and use.

Dr. Johnston explained that in Output 10.2.3, EPA puts a lot into the field work, partnering with the U.S. Department of Agriculture and U.S. Geological Survey. EPA does not want to drastically change the disinfection process. When it comes to metals and salts, urban areas are complicated cases to understand runoff. The goal is to provide more information on contaminant movement and potential threats to groundwater resources.

Output 1: Planning, Implementing, and Monitoring Stormwater Management Practices
Matt Hopton, Supervisory Biology, Center for Environmental Solutions and Emergency Response

Dr. Matt Hopton, Supervisory Biologist, CESER, described Output 10.1, which incorporates the work of 30 federal researchers with diverse expertise. The research was shaped by program offices, regions, and partners.

Research Output 10.1 includes three products, which include synthesizing models, methods, assessment data, and approaches that aid communities in stormwater management planning.

Dr. Hopton explained that the overall goal of this output is to help communities build stormwater management capacities.

Dr. Hopton explained that the first product is all recommendations that go into stormwater management planning and monitoring. The research in this product aims to create cost benefit analysis tools for comparing and evaluating management options for managing stormwater quality and quantity. This product also integrates sensing technologies, digital data tools, and smart learning for implementing stormwater management approaches. Lastly, the product integrates molecular stormwater pollutant technology to evaluate and enhance urban stormwater management for select microbial contaminants.

The second product addresses the problem of a lack of information on existing green infrastructure (GI). The actions of this product include conducting research on monitory GI and identifying best management practices to minimize combined sewer overflow (CSO) events. Dr. Hopton explained that the product's goal is to reduce CSO events by providing stakeholders information on GI and to provide tools for monitoring and optimizing stormwater management approaches.

Dr. Hopton provided an overview of the already complete third product, which consists of EPA's reports and training sessions being available online. The product research includes the Watershed Management Optimization Support Tool (WMOST), and includes user guides, theoretical documents, and training materials. The product helps with watershed management at both a large and local scale. The model also considers water flow and water quality. The outcome provides stakeholders with the tools to find cost-effective solutions involving integrated water management.

- **Robert Blanz:** How successful would a city council-person be in passing a tax to control stormwater?
    - **Matt Hopton:** Many areas are testing this out. There is a cost associated with this; someone must pay for it. There are a lot of issues that come with ignoring stormwater management, such as drinking water, contaminants, and water reuse.
    - **Ann Grimm:** There is a dividing line between policy and research. Regardless, we are paying for it one way or another.
- **Elizabeth Fassman-Beck:** How many people work on this research? I heard both 30 and 300.
    - **Matt Hopton:** There are 30 researchers in the stormwater program.
    - **Ann Grimm:** The 300 researchers come from CEMM, covering all programs.
- **Lucinda Johnson:** We heard a lot about contaminants, pathogens, and sodium, but nothing about nutrient loading in stormwater. Where is the nutrient issue dealt with?
    - **Suzanne van Drunick:** Nutrients and harmful algal blooms will be addressed later in 2021.

  - **Lucinda Johnson:** It concerns me that nutrients are not being mentioned in stormwater monitoring.
  - **Chris Impellitteri:** The assumption is that nutrients are absorbed and retained, but there are certain areas where that it is not the case.
- **Lucinda Johnson:** Are programs in Output 10.2 incorporating local communities into their group of collaborators and if they are being accounted for in the recommendations?
  - **Douglas Beak:** Yes, we have city data, state agencies, tribal communities, and federal agencies on board. Water resources are becoming a big issue in Oklahoma.

Board of Scientific Counselors Discussion of Charge Question 3

Joseph Rodricks, Chair, Safe and Sustainable Water Resources Subcommittee
Robert Blanz, Vice Chair, Safe and Sustainable Water Resources Subcommittee

The subcommittee discussed water quality issues with stormwater and disparities of water quality in communities with environmental justice concerns being bypassed.

Charge Question Breakout Groups

Breakout Group Discussion of Charge Question 1

Dr. Kate Lajtha explained how they thought Charge Question 1 was not written well. Ensuring that water is disinfected is a separate issue from lead issues. The Subcommittee was impressed by EPA's research. She inquired how the research translates to OW, because if OW has the power to make decisions, then what is the role of scientists to present the data driven results and recommendations? How is the research translated to the states and people who need to hear it? What are the scientists' roles in working with engineers and related professions to collaborate on the science?

Breakout Group Discussion of Charge Question 2

Dr. John White discussed the three ideas the workgroup drafted. In terms of water reuse, EPA should think about low energy and low-cost treatments to address the issues. He shared how they also discussed identifying partnerships at the state and local levels to help complete the work. Dr. Steve Weisberg explained that the Subcommittee would appreciate seeing some of the disjointed research packaged, and he mentioned the importance in prioritizing research.

Breakout Group Discussion of Charge Question 3

Dr. Elizabeth Fassman-Beck shared how it is important to provide context when considering research. The opposite side of these useful regional programs is that it is difficult to compile a compact narrative of ORD's work. The Subcommittee would appreciate seeing EPA scientists document their processes and explanations of how climate change impacts research.

Dr. Lucinda Johnson discussed how it would be useful to determine what pieces would be coherent to include.

- **Robert Blanz:** How will this research help the municipal separate storm sewer systems (MS4) stormwater permits treat stormwater?
    - **Elizabeth Fassman-Beck:** The challenges with this program is that EPA scientists are tackling numerous topics at once. ORD releases technical outcomes and technical products. There is a lack of standardization across the field, and it could be worthwhile for the Agency to standardized processes.

Next Steps

Joseph Rodricks, Chair, Safe and Sustainable Water Resources Subcommittee
Robert Blanz, Vice Chair, Safe and Sustainable Water Resources Subcommittee
Suzanne van Drunick, National Program Director, Safe and Sustainable Water Resources Research Program
Joe Williams, Principal Associate National Program Director, *Safe and Sustainable Water Resources Research Program*
Tom Tracy, Designated Federal Officer, Office of Science Advisor, Policy, and Engagement

Mr. Tom Tracy encouraged the Subcommittee to continue working with their workgroups and mentioned that the follow up meeting would be June 22, 2021. He clarified that the responses to the charge questions did not need to be finalized at that point.

Adjourn

The meeting adjourned at 5:15 p.m. Eastern Time

Tuesday, June 22, 2021

Welcome – Day 3

Tom Tracy, Designated Federal Officer, Office of Science Advisor, Policy, and Engagement
Joseph Rodricks, Chair, Safe and Sustainable Water Resources Subcommittee
Robert Blanz, Vice Chair, Safe and Sustainable Water Resources Subcommittee

The meeting reconvened at approximately 11:00 a.m. Eastern Time. Mr. Tracy opened the meeting and noted the proposed plan for the day. Dr. van Drunick would provide a presentation related to Charge Question 2 and then the subcommittees would breakout into discussion groups and work on responses to their assigned charge questions.

Dr. van Drunick opened the presentation and welcomed Dr. Grimm to introduce the team. Dr. Michael Jahne, Environmental Engineer, then presented on new systems for water reuse. The main factors that drove the current water reuse design are no longer relevant. Previously, there was plenty of water per man and fewer controls on treatment plants. However, water stress has become a major concern, and now there are better treatment technologies available to address water intake issues. The proposed research strategy will inform the transition between previous and future water reuse methods. These strategies focus on addressing research gaps for adoption of water reuse, centralized potable reuse, and onsite non-potable reuse. Dr. Jahne emphasized the

topic of non-potable reuse because the relative lack of research and engaged stakeholders, and the opportunity to explore deeper shifts in alternative water system configurations. He reviewed different research methods available to explore this, including Quantitative Microbial Risk Assessment (QMRA). In this method, EPA considers the exposure volume for different end uses and the density of pathogens and their respective dose-response in different source waters to predict what the risk would be of using the untreated water and estimate what the reduction should be of those contaminants.

- **Kate Lajtha:** Dr. Jahne mentioned that they focused on microbial load because there was not much chemical load in grey water or rainwater. Is there no concern for pharmaceuticals when dealing with black water? Pharmaceuticals are considered the agents of concern in Europe.
    - **Michael Jahne:** The water source is important, but when looking at non-potable use, it is important to note the end use. For example, water used for toilet flushing is not as important as drinking water.
    - **Kate Lajtha:** If human exposure is not a concern, is there a different standard for viral levels in potable versus non-potable water?
    - **Michael Jahne:** That is the big question here. The end exposure is important when trying to understand different standards. There is a bit of safety built into the models used to account for water misuse. Characterizing the exposure is a big part of this which then determines the quality.
- **John Lowenthal:** How does pumping well water for groundwater recharge fit into this process?
    - **Michael Jahne:** Aquifer recharge is important, and we do have work in this area, but this specific water reuse design work does not address it.
- **Joseph Rodricks**: I wanted to note that this work seems important and ambitious, and that the work is on-going as demonstrated by the list of references.

Charge Question Breakout Groups

Following breakout groups, Mr. Tracy reconvened the group and asked representatives from each charge question subgroup to report on what was discussed in their group during the breakout sessions.

Breakout Group Discussion of Charge Question 1

Dr. Lajtha summarized the draft strengths, suggestions, and recommendations discussed in their workgroup breakout. Topics included a *Legionella* risk model, information dissemination and knowledge transfer activities focusing on the end users, and increased research into anthropogenic chemicals such as pharmaceuticals. Dr. Lajtha went into greater detail on their draft recommendations, which focused on developing a risk-based model.

Breakout Group Discussion of Charge Question 2

Dr. White summarized the draft strengths, suggestions, and recommendations discussed in their workgroup breakout. He noted that Dr. van Drunick's presentation helped focus and develop their draft suggestions. Topics for suggestions included developing integration and reuse strategies. Dr. White provided an overview of the recommendations, which he mentioned were not final.

Dr. Steve Weisberg noted that the subcommittee is supportive of EPA work, and they are asking for some refinements that will make the products better.

Breakout Group Discussion of Charge Question 3

Dr. Fassman-Beck noted that although the workgroup got very far in their discussion, they scheduled another meeting to discuss their suggestions and recommendations further. She then summarized their current draft strengths, suggestions, and recommendations discussed in their workgroup breakout. She discussed that the stormwater management program is built on a strong interconnection of regional programs and a history of working with disadvantaged communities that is both appropriate and successful. Other topics included building stakeholder support, addressing climate change, addressing regional differences, focusing on pathogens, and addressing concerns around maintenance of systems. The recommendations discussed by the subcommittee related to developing new effective tools.

Closing Remarks

Mr. Tracy noted that the groups made progress and would reconvene on June 29, 2021.

Adjourn

The meeting adjourned at 2:00 p.m. Eastern Time.

Tuesday, June 29, 2021

Welcome – Day 4

Tom Tracy, Designated Federal Officer, Office of Science Advisor, Policy, and Engagement
Joseph Rodricks, Chair, Safe and Sustainable Water Resources Subcommittee
Robert Blanz, Vice Chair, Safe and Sustainable Water Resources Subcommittee

The meeting reconvened at approximately 11:00 a.m. Eastern Time. Dr. Rodricks opened the meeting and asked the charge question groups to report on their progress since the last meeting. He mentioned that after meeting in separate groups, everyone would come together to discuss environmental justice and equity topics as a whole and specifically within their charge question groups.

Dr. Lajtha noted that the Charge Question 1 group had met separately since the last meeting and only had minor changes to make to their recommendations.

Dr. White noted that the Charge Question 2 group had met separately since the last meeting and only had minor changes left to their recommendations.

Dr. Fassman-Beck noted that the Charge Question 3 group had met separately since the last meeting and only had minor changes to their recommendations.

Charge Question Breakout Group Reports

Dr. Fassman-Beck started the report outs with a summary of Charge Question 3's group work. She noted that the charge question has two parts and that their suggestions and recommendations addressed both parts separately and together where appropriate. She acknowledged that ORD has already done good stormwater management research in disadvantaged communities and an effective job addressing technical questions in these regions. Dr. Fassman-Beck noted that ORD can learn about the community benefits of stormwater management programs as a byproduct of the research.

She discussed that stormwater treatment systems in disadvantaged communities are typically in a worse state of repair because of a lack of resources. ORD has a unique opportunity to leverage improvements because of their partnerships in these communities but doing the research can take longer than actually implementing the program. One of the challenges that ORD faces is that conducting research on stormwater management is a long, time-consuming process, where there is a disconnect between the duration of developing duration these stormwater projects successfully and the duration of administrative attention. The disconnect might make it difficult to complete these long-term projects. Dr. Fassman-Beck noted that SWMM is a huge EPA success and should continue to be implemented and supported. She added that the projects on pathogens are timely and appropriate. According to Dr. Fassman-Beck, the third charge question group posed six suggestions, relating to synthesizing regional program approaches.

Charge Question Group 3 also had six recommendations which included conducting research into pathogens of concern and road salt issues, further developing SWMM, and integrating stormwater technical metrics with benefits in other areas (e.g., recreational water, etc.). Dr. Fassman-Beck suggested that trainings be implemented to help continue the work as EPA and ORD have Strategic Plans or priorities change and shift focus.

- **Joseph Rodricks:** Can you explain the idea about transferring research opportunities to community partners?
    - **Elizabeth Fassman-Beck:** After a 2 to 3-year research program is complete, the research moves to another area. We know that there are performance changes in these systems over time, and that it is hard for EPA to go back to areas they have already addressed, but they could include training for local partners that could continue on the research after ORD funding has run out for the area, then the research could continue.

Dr. White reviewed the Charge Question 2 group's recommendations. The group noted that EPA chose to bypass research on wastewater reuse, which is the largest reuse source. This is a good thing because there is already sufficient research in that area. Group 2 agreed that research on disinfection and treatment issues is important and appropriate, and that the program is well-integrated with research entities and other key partners.

The group mentioned the energy cost of reuse strategies but believed that low-cost treatment strategies could be valuable regardless of their carbon footprint, such as wetland systems in Europe. Group 2's only recommendation was to consolidate research into a product that communities can use to explore and understand the costs associated with different treatment options. Research needs to be delivered in a way that the public can actually use.

Dr. Lajtha summarized the work of the Charge Question 1 group. She noted that the research presented was cutting-edge and timely with work into disinfectant byproducts and emerging pathogens. She praised the collaborative research and communication between ORD groups and their partners and provided the group's suggestions.

Dr. Lajtha also recommended combining risk models that integrate various EPA research to examine exposures across pathogens, chemicals, pharmaceuticals, etc., and making the models work together. She also mentioned EPANET as useful a modeling tool but recommended that it be made as simple as possible for small systems and to allow end stream users to use it. She discussed the suggestion regarding pharmaceutical focus and asked the other subcommittee members to comment on the suggestion.

Dr. White noted that lifetime exposure to pharmaceuticals is very small, which is part of the reason why the United States focuses less on this topic, although Dr. Lajtha suggested that it could be important to consider this as it progresses and becomes more of an emerging issue. Dr. Tim Verslycke mentioned that EPA's OW conducts research on endocrine disruptors. Because this topic is within ORD's scope, ORD could build upon the expansive body of knowledge that already exists within the United States and the European Union.

Dr. Simmons noted that there has been a fair amount of work on pharmaceuticals globally. However, research typically focuses on "theoretical" mixtures of pharmaceuticals instead of ones that actually cooccur. It would be important to determine what chemicals are commonly present at more sites. She mentioned a study that has identified some of the most commonly occurring chemicals from 500 sites, underscoring that this work is not impossible and could be implemented. EPA is preparing an R app, and there is an opportunity to help develop datasets that could be used to determine what chemicals cooccur.

DRAFT

Closing Remarks

Mr. Tracy discussed what the next steps were, including making changes using the feedback given. Charge Question Groups 2 and 3 were done with their work, although Group 1 stayed longer to make changes to one of their suggestions.

Adjourn

The meeting adjourned at 12:45 p.m. Eastern Time.

DRAFT

Appendix A: Agenda

United States Environmental Protection Agency
Board of Scientific Counselors (BOSC)
Safe and Sustainable Water Resources Subcommittee Meeting
Meeting Agenda
May 26–27, 2021
Virtual

Day 1: Wednesday, May 26, 2021, Eastern Daylight Time

Time (EDT)	Topic		Presenter
11:45-12:00	Sign on and Technology Check		
12:00-12:15	Welcome and Opening Remarks		Tom Tracy (DFO) Joseph Rodricks (SSWR BoSC Chair) Robert Blanz (SSWR BoSC Vice Chair)
12:15-12:30	ORD Welcome		Jennifer Orme-Zavaleta (ORD Acting Assistant Administrator)
12:30-12:40	SSWR Overview and Charge Questions		Suzanne van Drunick (SSWR National Program Director)
12:40-1:15	ORD Center and Grants Overview		Greg Sayles (Director, CESER) Rusty Thomas (Director, CCTE) Mary Ross (Director, OSAPE)
1:15-1:25	Water Treatment and Infrastructure		Chris Impellitteri (Associate NPD, WTI Topic Lead)
1:25-4:30	Overview of Research Area 7: *Drinking Water Treatment and Distribution Systems*		Hale Thurston (ACD, CESER)
	1:30-2:00	Output 1: Resources and tools for characterizing and mitigating lead and copper release in drinking water distribution systems and premise plumbing	Darren Lytle (ORD, CESER) BoSC Q&A
	2:00-2:30	Output 2: Best practices, tools, and information for assessing and controlling pathogens and biostability in drinking water systems, managing disinfectant residuals, and minimizing DBPs	Eric Villegas (ORD, CEMM) BoSC Q&A
	2:30-3:00	Output 3: Analytical methods, occurrence, health effects, and treatment assessments to aid regulatory decision-making	Jane Ellen Simmons (ORD, CPHEA) BoSC Q&A

DRAFT

Time (EDT)	Topic		Presenter
	3:00-3:15	Break	
	3:15-3:45	Output 4: Resources and tools toward a systems approach for maintaining drinking water infrastructure performance and integrity	Regan Murray (ORD, CESER) BoSC Q&A
3:45-4:30	BoSC Discussion of Charge Question 1		Joseph Rodricks (SSWR BoSC Chair) Robert Blanz (SSWR BoSC Vice Chair)
4:30-5:00	Overview of Research Area 11: *Technical Support*		Ben Packard (ORD, OSAPE)
	4:35-5:00	Output 1: Technical support for water treatment, analytical methods, and risk assessments (Informational only – no charge question)	Craig Patterson (ORD, CESER) Michelle Latham (ORD IOAA) BoSC Q&A
5:00-5:15	Public Comments		Tom Tracy (DFO)
5:15-5:30	Wrap up		Joseph Rodricks (SSWR BoSC Chair) Robert Blanz (SSWR BoSC Vice Chair)
5:30	Adjourn		

Day 2: Thursday, May 27, 2021, Eastern Daylight Time

Time (EDT)	Topic		Presenter
11:15-11:30	Sign on and Technology Check		
11:30-11:40	Welcome – Day 2		Tom Tracy (DFO) Joseph Rodricks (SSWR BOSC Chair) Robert Blanz (SSWR BOSC Vice Chair)
11:40-12:00	ORD Centers Overview		Tim Watkins (Director, CEMM) Jamie Strong (Associate Center Director, CPHEA)
12:00-1:30	Overview of Research Area 9: *Wastewater and Water Reuse*		Ann Grimm (ACD, CEMM)
	12:05-1:00	Output 1: Analytical methods, exposure and effects assessment processes, and tools for wastewater and fit-for-purpose water reuse Output 2: Treatment technologies for wastewater and fit-for-purpose water reuse	Jay Garland (Associate Director, CESER)
1:00-1:30	BoSC Discussion of Charge Question 2		Joseph Rodricks (SSWR BoSC Chair) Robert Blanz (SSWR BoSC Vice Chair)

DRAFT

Time (EDT)	Topic		Presenter
1:30-1:45	Public Comments		Tom Tracy (DFO)
1:45-2:00	Break		
2:00-3:45	Overview of Research Area 10: *Stormwater Management*		Ann Grimm (ACD, CEMM)
	2:05-2:20	Output 2: Stormwater Management as a Resource for Enhanced Recharge, Capture, and Use (Informational only – no charge question)	John Johnston (ORD, CEMM) BoSC Q&A
	2:20-2:45	Output 1: Planning, Implementing, and Monitoring Stormwater Management Practices	Matt Hopton (ORD, CESER)
2:45-3:15	BoSC Discussion of Charge Question 3		Joseph Rodricks (SSWR BoSC Chair) Robert Blanz (SSWR BoSC Vice Chair)
3:15-3:30	Break		
3:30-4:30	Charge Question Breakout Groups (Committee members will be preassigned to specific charge questions)		BoSC & ORD
4:30-5:15	Charge Question Breakout Group Reports (15 mins each report)		Charge Question Leads
5:15-5:30	Next Steps		Joseph Rodricks (SSWR BoSC Chair) Robert Blanz (SSWR BoSC Vice Chair) Suzanne van Drunick (NPD, SSWR) Joe Williams (Principal Associate NPD, SSWR) Tom Tracy (DFO)
5:30	Adjourn		

DRAFT

Appendix B: Participants

BOSC Safe and Sustainable Water Resources Committee Members:

Joseph Rodricks, *Chair*
Robert Blanz, *Vice Chair*
Scott Ahlstrom
Jerad Bales
Steve Carr
Shahid Chaudhry*
David Cole
Timothy Davis*
Joel Ducoste*
Elizabeth Fassman-Beck
Fred Hitzhusen
Lucinda Johnson, BOSC Executive Committee Vice Chair
Kate Lajtha
Michelle Lorah
John Lowenthal
Tim Verslycke
Stephen Weisberg
John White

** did not attend*

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

EPA Presenters:

Jay Garland, *Associate Director, Center for Environmental Solutions and Emergency Response*
Ann Grimm, *Acting Center Director, Center for Environmental Measurement and Modeling*
Matt Hopton, *Supervisory Biologist, Center for Environmental Solutions and Emergency Response*
Chris Impellitteri, *Associate National Program Director, Water Treatment and Infrastructure Topic Lead*
John Johnston, *Chief of Landscape and Aquatic Systems Modeling Branch, Center for Environmental Measurement and Modeling*
Michelle Latham, *Biologist, Office of Research and Development*
Darren Lytle, *Engineer, Center for Environmental Solutions and Emergency Response*
Regan Murray, *Director, Water Infrastructure Division, Center for Environmental Solutions and Emergency Response*

DRAFT

Ben Packard, *Biologist, Office of Science Advisor, Policy, and Engagement*
Craig Patterson, *Environmental Engineer, Center for Environmental Solutions and Emergency Response*
Bruce Rodan, *Associate Director for Science, Office of Research and Development*
Mary Ross, *Director, Office of Science Advisor, Policy, and Engagement*
Greg Sayles, *Director, Center for Environmental Solutions and Emergency Response*
Jane Ellen Simmons, *Chief of Integrated Health Assessment Branch, Center for Public Health and Environmental Assessment*
Jamie Strong, *Associate Center Director, Center for Public Health and Environmental Assessment*
Russell Thomas, *Director, Center for Computational Toxicology and Exposure*
Hale Thurston, *Acting Center Director, Center for Environmental Solutions and Emergency Response*
Suzanne van Drunick, *National Program Director, Safe and Sustainable Water Resources Research Program*
Eric Villegas, *Microbiologist, Center for Environmental Measurement and Modeling*
Tim Watkins, *Director, Center for Environmental Measurement and Modeling*
Joe Williams, *Principal Associate National Program Director, Safe and Sustainable Water Resources Research Program*

Other EPA Attendees:

Ryan Albert
Swinburne Augustine
Vince Bacalan
Peter Bahor
Nizanna Bathersfield
Douglas Beak
Lara Beaven
Barbara Bergen
Jason Bernagros
Heidi Bethel
Pradnya Bhandari
Karen Blockso,
Laura Boczek
Tracy Bone
Hannah Boone
Michael Borst
Justin Bousquin
William Boyes
Angela Brown
Cheryl Brown
Tim Buckley
Robert Burgess
Bekah Burket
Jonathan Burkhardt
Helen Buse
Greg Carroll
Wayne Cascio
Rabia Chaudhry
Miranda Chien-Hale
Jay Christensen
Bryan Clark
Phil Colarusso
Jana Compton
Joel Corona
Lesley Danglada
Naomi Detenbeck
Joyce Donohue
Maura Donohue
Russell Erickson
Bill Fisher
Ken Fritz
Jay Garland
Andrew Geller
Susan Glassmeyer
Heather Golden
Rick Greene
Shannon Griffin
Yu-Ting Guilaran
Linda Harwell
Levi Haupert
Daniel Hautman
Terra Haxton
Matt Herberling
Annelise Hill
Kay Ho
Scott Jacobs
Robert Jankie
Thomas Johnson
Elizabeth Kakaley
Ann Keeley

DRAFT

Elaina Kenyon
Rose Kwok
David Lattier
Sang Don Lee
Sarah Lehman
Jingrang Lu
Cissy Ma
Gouri Mahadwar
Paul Mayer
Marissa Mazzotta
Richard Mitchell
Michael Morton
Cristina Mullin
Dan Murray
Diane Nacci
Deborah Nagle
Sharon Nappier
Jill Neal
Amy Newbold
Jane Nishida
Thomas O'Farrell
Edward Ohanian
Jennifer Orme-Zavaleta
Kevin Oshima
Steve Paulsen
Marguerite Pelletier
Amina Pollard
Brenda Rashleigh
John Ravenscroft
Anne Rea
Jay Reichman
Matthew Richards
Paul Ringold
Cindy Roberts
Sandra Robinson
Crystal Rodgers-Jenkins
Marc Russell
Deborah Santavy
Marika Schulhof
Ari Selvakumar
Gregg Serenbetz
Feng Shang
Orin Shanks
Nicole Shao
Michelle Simon
Janice Sims
Bernice Smith
Bruce Smith
James Smith
Lisa Smith
Heather Strathearn
Kate Sullivan
Avery Tatters
Michelle Thawley
Emily Trentacoste
Scarlett VanDyke
Katrina Varner
Eunice Varughese
Chau Vu
Lili Wang
Marc Weber
Susan Yee
Richard Zepp
Robert Zucker
Todd Lutte

Other Attendees:

Astrika Adams
Rebecca Adler Miserendino
Ayomide Akintunde
Michael Altman
Oluwafemi Bakare
Brian Chalfant
Ashley Clark
K Cunning
Jeff Czarnecki
Robert Edelman
Francisco Javier Galindo Soria
Sam Grainger
Rebecca Hammer
Ben Kallen
Christa Kananen
Alex L
David LaRoss
Jeremy Lerner
Alvina Mehinto
Saheed Muftaudeen
Jan Nowak
Jeffrey Phillips
Craig Updyke
Steve Via
Linda Wilson
Daniel Wilson

Contractor Support:

Steven Black
Canden Byrd
Blake Riley
Amy Scheuer

Appendix C: Charge Questions

Q.1: The SSWR research program is implementing drinking water and distribution system research focused on lead and copper control, management of disinfection by-products (DBPs), and opportunistic pathogens. These issues are especially challenging for small systems and some environmental justice communities. What suggestion(s) and recommendation(s) does the Subcommittee have on ORD's implementation of its drinking-water and distribution research, and in particular on how these research activities can be comprehensively integrated to ensure safe disinfectant levels, while minimizing or eliminating exposure to lead, opportunistic pathogens, and DBPs in small treatment and distribution systems and in disadvantaged communities?

Q.2: ORD water reuse researchers have worked closely with other organizations (e.g., Water Research Foundation) to avoid duplicate research, especially in large municipal direct potable reuse systems. This coordination led to SSWR implementation research focused on non-municipal sources of wastewater (e.g., industrial, agricultural) and decentralized non-potable end uses that can contribute to increased resiliency of water resources, especially in areas facing increased frequency, intensity, and duration of higher temperatures and drier climate patterns. Please comment on the implementation of ORD's water reuse research, and what suggestion(s) and recommendation(s) does the Subcommittee have regarding SSWR's water reuse research for helping to innovatively augment water supplies and improve resiliency by identifying promising alternative water sources?

Q.3: Stormwater management approaches can decrease stormwater runoff to wastewater treatment systems (combined sewer systems) and stream discharges (municipal separate storm sewer systems). Consequences from combined sewer systems frequently affect lower-income areas in urban settings. These effects might exacerbate in areas subjected to increased intensity, duration, and frequency of extreme precipitation events. In addition to evaluating ORD's stormwater research activities, what suggestion(s) and recommendation(s) does the Subcommittee have to improve the utility of these research activities to provide integrated decision-support tools for stormwater management in disadvantaged communities.