U.S. Environmental Protection Agency (EPA) Board of Scientific Counselors (BOSC)

Sustainable and Healthy Communities Subcommittee

Face-to-Face Meeting Minutes

November 2–4, 2016

DRAFT

Date and Time: November 2, 2016, 12:00 p.m. to 6:30 p.m.; November 3, 2016, 8:30 a.m. to 5:45 p.m.; November 4, 2016, 8:00 a.m. to 2:00 p.m. Eastern Time

Location: EPA Andrew W. Breidenbach Environmental Research Center, 26 W. Martín Luther King Drive, Cincinnati, Ohio

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 and the participants are listed in Appendix B.

DRAFT

Wednesday, November 2, 2016

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

Welcome and Introduction of BOSC Members and Program Office/Regional Office Visitors

Robert Richardson, Subcommittee Chair; Andrew Geller, Acting National Program Director (NPD)

Dr. Robert Richardson, chair of the U.S. Environmental Protection Agency (EPA) Board of Scientific Counselors (BOSC) Sustainable and Healthy Communities (SHC) subcommittee formerly opened the meeting. He welcomed the subcommittee members introduced himself and the vice chair, Dr. Courtney Flint.

Dr. Richardson recalled that the subcommittee met last September and that the subcommittee was pleased with the discussion and outcome following the previous meeting. He explained that this meeting was designed to focus on SHC research topic 3: Sustainable Approaches for Contaminated Sites and Materials Management. Within that research topic, there are three projects: 3.61 Contaminated Sites, 3.62 Environmental Release of Oils and Fuels, and 3.63 Sustainable Materials Management. Dr. Richardson pointed out that the subcommittee varies in their levels of experience and expertise in the subject matter of the three research topics. He requested that each subcommittee member introduce themselves and describe their experience or expertise in one or more of the research project themes to help the subcommittee determine the best approach to respond to the charge questions. Dr. Flint asked the subcommittee to also note if their expertise is aligned with the community sustainability perspective of the research topics.

Mr. Matthew Naud is the Environmental Coordinator for the City of Ann Arbor, Michigan. He is a member of Urban Sustainability Directors Network. He has a fair amount of experience with contaminated sites and has consulted with EPA and its Chemical Emergency Prevention and Preparedness Office on spill response. He explained that the City of Ann Arbor has many volatilization and indoor air issues, ground fuel re-development, and contaminated sites issues. He concluded that he can bring an urban perspective to the subcommittee's discussions.

Dr. Robert Cervero is a Professor of City and Regional Planning and Environmental Design at the University of California – Berkeley. While his background and experience in these three research topic areas is limited, he does have experience working on urban regeneration with a focus on economics, site remediation, and alternative land uses.

Dr. Elena Irwin is an Environmental Economist in the Department of Agricultural, Environmental, and Development Economics at the Ohio State University. While she has limited expertise and experience in these three research topic areas, she brings to the subcommittee a background and research experience in the economics and impacts of land use, ecosystem service evaluation models, and urban redevelopment.

Dr. Andrew Dannenberg is a Physician in the School of Public Health, Department of Urban Design and Planning at the University of Washington – Seattle. He is also a Professor in Environmental and Occupational Health Sciences, and his work is focused on health and the environment and sustainability. Formerly, he worked at the Centers for Disease Control (CDC) on the Healthy Community Design Initiative.

Mr. James Kelly has worked for the past 15 years at the Minnesota Department of Health under an Agency for Toxic Substances and Disease Registry cooperative agreement. He manages a group that conducts a range of environmental activities including public health assessments of contaminated sites and health impact assessment. He currently works with vapor intrusion sites and a large fluorochemical groundwater contamination site in the Twin Cities. Thus, he has experience working with contaminated sites. He also worked as a remedial project manager at the Minnesota Pollution Control Agency.

Dr. Courtney Flint is a Community and Natural Resource Sociologist at Utah State University. Her recent experience is focused on community sustainability. She also has a background in risk assessment, emergency preparedness, and disaster planning.

Dr. Robert Richardson works in the Department of Community Sustainability at Michigan State University. His training is in environmental economics. While he does not have specific expertise in these research topics, his background is similar to Dr. Irwin's and includes research in ecosystem services and their contributions to well-being. His interest lies mostly in the connection of community sustainability to these research topics.

Dr. Earthea Nance is a Professor at Texas Southern University in Houston. She is trained in environmental engineering and environmental planning and management. Her research interests are the social impacts of environmental hazards. Her recent work is focused on flooding and disaster recovery. She also worked as an official in New Orleans after the Hurricane Katrina disaster. She has recently published on the air impacts of oil spills including the Deepwater Horizon spill. She has experience in participatory development and infrastructure, specifically with communities in poverty. She shared that she could provide the most assistance responding to the charge questions on the research topic on 3.62 Environmental Releases of Oils and Fuels.

Dr. John Tharakan is a Professor of Chemical Engineering at Howard University. He has research experience in remediation of hazardous waste sites and is part of EPA's Great Lakes and Mid-Atlantic Hazardous Substances Research Center. The center is focused on remediation of polychlorinated biphenyl (PCB)-contaminated sludge and other contaminated sites.

Dr. Carlos Martín is a Senior Fellow at Metropolitan Housing and Communities Policy Center at the Urban Institute in Washington. He is a trained architect and construction engineer. His experience is focused on land use and remediation of brownfields as well as sustainable materials management, including life-cycle analysis of building and construction materials.

Dr. Peter Meyer is the Chief Economist and President of the EP Systems Group. Formerly, he was Director of the Center of Environmental Policy and Management at the University of Louisville. He began working with brownfields for EPA in 1993. He also spent 1 year working on underground storage tanks, in particular financing their re-development. He stated that his experience would be most useful when addressing the research topics 3.61 Contaminated Sites and 3.62 Environmental Release of Oils and Fuels.

Dr. Leslie I. Rubin is a Pediatrician affiliated with the Emory University School of Medicine in Atlanta. He is primarily involved at a clinical level with children with disabilities and the impact of the environment on children's health. He has experience with contaminated soil. He stated that his background is in examining how environmental contamination affects the community and his interests have evolved into children's environmental health disparities and environmental justice.

Mr. Mike Steinhoff is a Program Director at ICLEI-USA, which is a membership association for local governments. His primary role is in greenhouse gas accounting. With respect to the research topics, his experience aligns most closely with sustainable materials management, life cycle perspectives, and tools like the Waste Reduction Model (WARM).

Dr. Richardson pointed out that three SHC subcommittee members, Dr. Richard Feiock, Dr. Bill Tomlinson, and Dr. Todd BenDor, were unable to attend the meeting in person. Dr. BenDor will participate in the meeting virtually from London.

Dr. BenDor introduced himself and apologized that he could not attend the meeting in person. He is an Assistant Professor in the Department of City and Regional Planning at the University of North Carolina – Chapel Hill. His work is focused on emerging market and their intersection with urban planning as well as the environmental impacts of growth. He participated on a project several years ago modeling brownfields redevelopment policy. He is primarily interested in research topic 3.61 Contaminated Sites and in environmental justice.

Dr. Richardson reminded the subcommittee of their first meeting to review the SHC research program in September 2015 at Research Triangle Park, North Carolina. At that 2-day meeting, the subcommittee discussed six charge questions and worked in small groups to write their report for the BOSC Executive Committee. One piece of feedback in that report was that it would be useful for the subcommittee to interact with research laboratories and scientists. This provided the motivation for the current meeting. The SHC National Research Program was most interested in focusing on research topic 3: Sustainable Approaches for Contaminated Sites and Materials Management. He reiterated that the BOSC SHC subcommittee is diverse and at different stages of the learning curve in regards to this research topic. He asked Dr. Andrew Geller to introduce the participants that were present from program and regional offices.

Dr. Geller thanked everyone for being present and stated this is an opportunity for SHC to engage with their program office partners and learn about their research issues in order to match the National Research Program with their partner's issues. He introduced the program office/regional office (PO/RO) visitors present in the room, including Dr. Kathleen Raffaele, Senior Scientist at EPA's Office of Land and Emergency Management (OLEM), Mr. Stiven Foster, Senior Scientist at OLEM, Tim Taylor, their Research Coordinator from OLEM's Office of Research Conservation and Recovery (ORCR) at OLEM, Dr. John Cardarelli from the Office of Emergency Management (OEM) at OLEM, Ms. Kira Lynch, their Superfund and Technical Liaison (STL) from Region 10, and Ms. Diana Cutt, their STL from Region 2.

Dr. Raffaele introduced herself and explained that OLEM was renamed since the last meeting of the BOSC SHC subcommittee. It was formerly called the Office of Solid Waste and Emergency Response (OSWER). She explained that while the name has changed, the office still has the same programs. She explained that most of the PO/RO visitors present will be talking the subcommittee later in the meeting in more detail.

Ms. Cutt introduced herself and explained that, until recently, Region 2 (including New York and New Jersey) was the lead region for Superfund. Over the past 2 years, she has been heavily involved SHC activities. Ms. Lynch added that she and Ms. Cutt are actually Office of Research and Development (ORD) employees who sit in the regional offices. Their responsibility is to act

as a link between the program offices and ORD in order to bring the science from ORD into their regions.

Dr. Richardson thanked the EPA staff and pointed out that the subcommittee will meet the rest of those present from ORD over the course of the next few days.

DFO Welcome
Jace Cujé, Designated Federal Officer (DFO)

Mr. Cujé welcomed the participants and provided an overview of meeting logistics. Two of the SHC BOSC subcommittee members were unable to attend the meeting (Dr. Feiock and Dr. Tomlinson). He explained that the BOSC executive committee was re-chartered in 2014, and there are five BOSC subcommittees, including the SHC subcommittee. This subcommittee will provide targeted advice on the SHC research program and, in particular, the Strategic Research Action Plan (StRAP) from 2016–2019. The StRAP is a living document that can be modified to reflect emerging needs and programmatic desires. All of the SHC materials are posted online. There will be three separate poster sessions. This subcommittee will submit its report to the BOSC Executive Committee who will meet in January. This subcommittee itself is not chartered under the Federal Advisory Committee Act (FACA). Under EPA policy, this subcommittee will still meet all of the FACA openness requirements, which include *Federal Register* notices and meeting minutes. He reported that EPA did not receive any written public comments relating to this meeting in the docket or any requests to make public comments. There is a requirement under FACA to ensure there is no conflict of interest within the subcommittee members and that the subcommittee members are independently reviewing the SHC research program. He had not identified any conflict of interest issues. Reiterated that chairs run the meeting and turned it over.

SHC Welcome
Andrew Geller, National Program Director of EPA ORD SHC National Research Program; Cindy Sonich-Mullin, Director of National Risk Management Research Laboratory, EPA ORD

Dr. Geller stated that ORD is here to listen and to be heard and also to learn and to evaluate. ORD staff will use what they learn to plot their path forward. EPA's OLEM, the regions, and those who staff the states and other delegated programs face a gargantuan task. They have the responsibility to deal with the legacy of the industry and activities that built America's infrastructure, provided jobs and income to millions, and provided goods and services to the world. This means working together to clean up sites like the steel plants that once were economic engines in Duluth, Minnesota and Gary, Indiana; the mining sites that provided the ore; and the myriad of other sites located inside and outside of our urban centers where hazardous wastes were produced and are now intentionally or unintentionally stored; and in the lakes, rivers, and streams where contaminated sediments ultimately came to rest. OLEM, the regions, and states are charged with removing toxic threats to families, the environment, and the organisms that live in our soils, rivers, lakes, and oceans as well as returning these sites to productive use for communities and functioning ecosystems. These are the underpinnings of sustainable communities. Finally, Dr. Geller stated that OLEM, the regions, and states are charged with the generation of rules, regulations, and guidance to handle the material flows that are the byproducts of our everyday lives (e.g., municipal solid waste, construction and demolition debris, and controlled hazardous materials) so that EPA does not perpetuate the generation of a toxic legacy for the next generation.

Dr. Geller explained that SHC's research and development, in the areas of contaminated sites and sediments, environmental releases of oils and fuels, and sustainable materials management and reuse of materials, is essential to this task. ORD has the challenging roles of: acting as a consultant on both regulatory and remediation issues, based on the tremendous depth of knowledge of ORD's scientists and engineers; serving as developers and evaluators of site characterization and remediation technologies; and providing scientists oriented toward that critical task of considering the long term, whether it is for industrial processes and developing methods and databases for life cycle analysis assessment, and the ultimate development of more circular material flows, how to evaluate the safety of materials that we hope may be put into productive use and reuse as they move through their life cycles, and how to safely handle the unavoidable waste and accidental spills and releases that people produce.

Dr. Geller noted that ORD and EPA's partners are present at the meeting to mark where they are at this point in time and the progress we've made in this shared task of developing rules and regulations, remediating contaminated sites, and handling materials. He continued that ORD is present also to discuss with OLEM and the regions the pressing research needs that they have identified and to communicate the tremendous body of research that ORD's scientists have produced in these areas. He noted that the BOSC SHC subcommittee is present at the meeting to observe the nature of their interactions; to evaluate the alignment of ORD's research with the Agency's mission in these areas in the near-term, long-term, and for evolving issues; and to consider the quality and direction of SHC's research and development.

Dr. Geller explained that SHC, OLEM, and the regions are in regular contact at the staff and management levels to consider the "parts" (of the research portfolio). However, events like this are necessary to consider the "whole" research portfolio. The materials provided to the subcommittee in advance of the meeting and the posters and presentations provided during this meeting provide information about how SHC research has informed the development of OLEM and OW policy, how SHC researchers interact with EPA's regions to address real problems across the country, and provide information for the subcommittee to evaluate SHC's plans and scientific achievements. He clarified that all of the research planning documents, from the StRAP down to the project plans, should not be viewed as static. While these materials do project a trajectory and define commitments to produce useful science, ideas are still presented in subsequent conversations with ORD scientists. The science is exciting and discovery is energizing and reinforcing. The research that SHC is doing is critical to the health and well-being of this country's communities. This makes their discoveries tremendously gratifying.

In the BOSC report, the SHC subcommittee recommended that future meetings of the BOSC and SHC provide opportunities for greater interaction with staff from ORD's centers and laboratories as well as stakeholders in the Agency and partnering regions. Dr. Geller explained that these meetings are designed to do that. Furthermore, the meetings have been designed so that ORD can: listen and learn from their Agency partners about the research they need to facilitate accomplishment of their mission; provide concrete examples of successes in the interactions between ORD scientists, the regions, and the states in solving problems; and to learn from ORD's scientists about this critical work.

Dr. Geller acknowledged that this research falls outside the area of expertise of many of those present at the meeting. He stated that communicating this work to both technical and non-

technical audiences is a challenge that ORD faces every day thus, the BOSC serves to provide continuing education on how best this can be done.

Dr. Geller thanked the subcommittee for their participation. He also thanked EPA's program and regional scientists for preparing the meeting materials and attending the meeting as well as EPA personnel in Cincinnati who prepared the meeting space and materials, and EPA SHC staff and contractors.

Dr. Geller introduced Ms. Cynthia Sonich-Mullin, the laboratory director of EPA's National Risk Management Research Laboratory (NRMRL). Ms. Sonich-Mullin shared that the Andrew W. Breidenbach Environmental Research Center (AWBERC) is primarily a research center and is the second largest ORD research and development facility in EPA, with the largest being Research Triangle Park in North Carolina. The center's roots extend from a history of solid waste and drinking water; however, it now covers staff in all of EPA's national programs in the building. The facility acts as the headquarters for NRMRL and the National Homeland Security Research Center (NHSRC) formed in 2001. The center also has a large presence of EPA's National Exposure Research Laboratory (NERL), the National Center for Environmental Assessment (NCEA), and a number of ORD administrative offices. One of their close partners, the Office of Water (OW), is also in the building. Another close partner, OLEM, is nearby in Erlanger, Kentucky.

Ms. Sonich-Mullin explained that there are three other EPA research facilities in the Greater Cincinnati area, including the Center Hill facility, a testing and evaluation facility (co-located with the City of Cincinnati's Municipal Sewer District), and an environmental streams facility doing state-of-the-art work on simulated streams and watersheds. EPA's Region 5 representatives are also at the Erlanger, Kentucky facility. These facilities work together to meet the goals of the Agency. ORD's close relationship with OLEM has become part of ORD's identity with respect to their research portfolio. The SHC research program's goals focus on healthy and safe communities, and the products and tools they develop are set up to provide solutions to environmental challenges that communities face. The SHC research program focuses on place-based research and bringing research into the communities.

Ms. Sonich-Mullin mentioned that ORD has five technical support centers throughout the United States that help to ground truth the research, bring the research tools to the regions and communities, and allow input from the communities to help plan the research. This helps to make sure all of research is relevant and appropriate to the programs, regions, states, and local communities. NRMRL has two of the five technical support centers: the Engineering Technical Support Center and the Ground Water Technical Support Center. Three centers are focused on site characterization and modeling and located primarily in Washington, DC. Two other centers, the Superfund Health Risk Technical Center and the Ecological Risk Assessment Support Center, are risk assessment based technical centers headquartered in Cincinnati, Ohio.

Ms. Sonich-Mullin stated that the research laboratories and technical centers are part of the four major programs in ORD, and they have input to the other programs. They have a long-standing goal of addressing OLEM's needs, researching contaminated sites, sustainable materials management, and oil spills. She explained that on the tour at AWBERC, the subcommittee will speak with Dr. Robyn Conmy about oil spills and Dr. Marc Mills about analysis of contaminants of emerging concern as well as Great Lakes Program Office and Superfund contaminated

sediments. At the Center Hill facility, the subcommittee will talk with researchers about oil simulants and leaching materials for remediation.

Review of Charge Questions
Robert Richardson, Chair

Dr. Richardson stated that, at the face-to-face meeting in September 2015, the subcommittee reviewed the SHC StRAP and responded to six charge questions. At this meeting, the subcommittee will focus on one specific topic (Sustainable Approaches for Contaminated Sites and Materials) and three specific projects under that topic: 3.61 Contaminated Sites, 3.62 Environmental Releases of Oils and Fuels, and 3.63 Sustainable Materials Management.

Dr. Richardson read each charge question and highlighted key words for the subcommittee to contemplate. He noted that the first two charge questions ask for specific feedback on the three project areas.

> *Charge Question 1: How well do SHC's research and development accomplishments and proposed research address high priority Agency, state, and community needs in this area?*

Dr. Richardson called for the subcommittee to consider what they see and learn over the course of this meeting. There are high priority needs that vary at the Agency, state, and community levels. ORD asked the subcommittee to address this charge question with respect to the needs at those three scales for each project.

> *Charge Question 2: How well does SHC's planned research anticipate future problems in this area and address longer-term community sustainability and environmental justice goals?*

Dr. Richardson emphasized that three key words/phrases to focus on for this question are: anticipating future problems, addressing longer-term community sustainability, and addressing environmental justice goals.

> *Additional Charge Question (3): Do you see SHC's Sustainable Approaches for Contaminated Sites and Materials projects, and associated research from other parts of SHC, as helping communities achieve sustainability?*

Dr. Richardson stated that this is an integrative question. It is about the topic as a whole and its link to helping communities achieve sustainability.

Dr. Richardson explained that over the course of this meeting, the subcommittee will likely organize into smaller groups to address charge questions 1 and 2 for research topics 3.61, 3.62, and 3.63. An additional small group will address charge question 3. The subcommittee will discuss the approach for responding to charge questions on Friday and work in small groups via email to finish the responses leading up to the subcommittee submitting its final report to the BOSC Executive Committee in December.

Public Comments
There were no public comments.

Research Prioritization Process
Kathleen Raffaele, OLEM; Diana Cutt, Region 2/ORD

Dr. Raffaele stated that OLEM is a large office with a number of sub-offices (e.g., Emergency Management, Superfund Remediation and Technology Innovation, Resource Conservation and Recovery, Underground Storage Tanks (UST), Brownfields and Land Revitalization) that overlap under the broad area of work focused on contaminated sites. These offices support a variety of work and the presentations at the current meeting will focus on work that supports contaminated sites.

Dr. Raffaele explained that OLEM works under several laws and writes regulations, develops guidelines and policies, and provides technical assistance. OLEM depends on ORD for support in all of these areas. Specific OLEM activities include: providing policy, guidance and direction for the Agency's land and cleanup programs; developing guidelines for disposal of hazardous waste and underground storage tanks; administering the Brownfields Program, which supports state and local governments in redeveloping and reusing potentially contaminated sites; managing the Superfund program which responds to abandoned and active hazardous waste sites and accidental chemical releases; and assisting other federal agencies with their environmental compliance.

Dr. Raffaele provided a slide highlighting the following examples of how OLEM applies ORD research. The research provides support for: national-scale regulatory activities (e.g., rule development primarily for the Resource Conservation Recovery Act [RCRA]); Sustainable Materials Management (SMM) Program; site specific risk assessments (the assessments are typically conducted by regional offices, but OLEM provides guidance and technical support); and emergency response (e.g., oil spills).

Dr. Raffaele explained that each OLEM office has developed a process, which engages a representative from each sub-office on the Research Coordination Team that meets regularly to discuss research needs and priorities given that ORD has limited resources. They are currently in the middle of updating their research needs. They are at the point right now where all of the offices have identified their research needs. During the next step of research prioritization, the Policy Analysis and Regulatory Management Staff (PARMS) science team collates and coordinates the needs. This team collates and organizes office-specific research support needs, coordinates with OLEM Research Coordination Team regarding areas that overlap across OLEM offices, and coordinates with regional scientists regarding regional science support needs. They have not yet completed the next step, which is the OLEM cross-office discussion to identify the highest priority OLEM research support needs. They will also coordinate with regional scientists to determine if OLEM’s priorities overlap with their priorities. The final step is to have research planning discussions with ORD about resources, existing research commitments and whether resources need to shifted to more closely align with OLEM research needs. ORD is in the process of forming Partner Alliance and Coordination Team (PACTs) that will work closely with the programs and the regions to ensure the research stays aligned. The program offices and regions will be closely involved with PACTs.

Ms. Cutt provided a brief overview of how the regions determine their science and research needs. She reiterated that ORD has to account for the science needs of OLEM and the ten regions. A consistent process for determining science needs is not implemented across the ten

regions. However, at least half of the regions have a similar process, including Region 2. Ms. Cutt provided a description of Region 2's process. The annual process starts with a Regional Science Council that has representatives from each division and program within the region (e.g., Air, Water, RCRA, Superfund, Environmental Justice, and Children's Health). Every year, there is a meeting involving Senior Scientists from each division to revisit the list of needs (initially developed in 2010) to make sure it is current. The research being conducted by ORD and other support groups is reviewed to ensure it is still a priority for the divisions. The final list of science needs ends up with the Regional Administrators who then adds their own needs if necessary. The final list is used to strategically allocate resources, target science-related requests for proposals, such as Regional Applied Research Effort (RARE) projects, and help the regions respond in a timely and consistent manner to internal and external requests (e.g., NEIHS) for science needs. In the near future, they are evolving to work toward identifying cross-regional common needs to identify common ground for prioritization. She pointed out that most of OLEM's needs incorporate regional needs related to contaminated sites research, which she anticipates will be even better coordinated in the future to ensure they speak with a unified voice. The regions appreciate being represented in this meeting.

Dr. Richardson pointed out that the comments from Ms. Cutt and Dr. Raffaele are helpful as the subcommittee contemplates charge question 1.

Program and Regional Office Overview of Research Needs
Stiven Foster, OLEM

Mr. Foster discussed his role in PARMS and the three offices within OLEM that are most in need of research to support the environmental release of oils and fuels.

Mr. Foster provided background information on OEM. OEM is responsible for implementing the National Response System (NRS) to prevent, prepare for, and respond to a wide range of oil discharges and hazardous substance releases through the National Contingency Plan (NCP). The NCP ensures the federal government's resources and expertise are immediately available for emergencies beyond the capabilities of local and state responders. Under the NCP, EPA chairs the National Response Team (NRT), co-chairs the 13 Regional Response Teams (RRTs), provides the Federal On-Scene Coordinators (OSCs) for the inland zone, and is responsible for maintaining the NCP. The NRT coordinates responses to emergencies across the country and establishes command centers. A focus of their efforts is responding to the releases of oils and fuels. Subpart J of the NCP deals specifically with the use of chemical and biological agents. EPA concurrence is needed before new chemicals and biological agents can be authorized to treat oil spills.

Mr. Foster provided background information on the Office of Underground Storage Tanks (OUST), noting members would be hearing about some of the successful OUST-ORD partnerships. The program was originally authorized under the Solid Waste Disposal Act with the addition of Subtitle I in 1984. This authorized EPA to develop a comprehensive regulatory program for USTs storing petroleum or certain hazardous substances to protect the environment and human health from UST releases. There are many USTs and a number of specific research needs. Federal UST regulations require preventive measures (such as spill, overfill, and corrosion protection), release detection monitoring, corrective action, and demonstration of

financial resources to carry out corrective action. EPA's 1988 regulations set minimum standards for new tanks and required owners of existing tanks to upgrade, replace, or close them.

Mr. Foster provided background information on EPA's Brownfields Program within OLEM. This program is authorized under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and deals with revitalizing lands that are underutilized due to contamination. The program deals with fuels and has similar needs as the OUST program.

Mr. Foster described the broad research needs for oil spills, including:

- Toxicity testing research specific to dispersants, solidifiers, and surface washing agents in addition to evaluating their effectiveness for both fresh and saltwater environments.
- Both effectiveness and toxicity testing protocols specific for herding agents, sorbents, and burning agents also need to be developed and refined.
- Chemical and toxicity characterization of EPA reference oil selection, including developing methods and standardizing protocols. (OEM relies heavily on ORD to provide assistance with this.)
- Chemical agent fate/transport studies in both fresh and salt waters, including evaluation of spill response assets (i.e., cleanup agents).
- Fate/transport/chronic impacts of unconventional oils (e.g., diluted bitumen, Bakken oil) in aquatic ecosystems.

Mr. Foster described the broad research needs for underground storage tanks, including:

- Evaluating new technologies, such as carbon-based injectables. They are looking to partners in ORD to help them determine the efficacy of this new technology.
- Models to address gaps in knowledge of vapor intrusion from petroleum sources, fate and transport of contaminants, and assessing groundwater vulnerability that complements geographic information system (GIS) research.
- Applied technical assistance (albeit broader than 3.62); Regions often could not respond to releases in the field without the technical support of ORD.

Dr. Martín asked about the role of OEM. Mr. Foster mentioned that OEM is responsible for prevention, preparedness, and response to releases. He asked if Mr. Foster would classify any of OEM's research needs as related to prevention or preparedness.

Mr. Foster responded that he does not think any of the specific needs he mentioned fall into prevention or preparedness. He stated there are a number of rules in place and some science needs for preventing releases. In the regulatory world, the question of deregulation is often considered and if specific sources should be regulated. In other cases, new sources that do need to be regulated are considered as well as if new sources might have potential for release.

Dr. Meyer asked how volatile organic compounds (VOCs) are handled in cases of contaminated sites. He wondered if natural attenuation is part of the research agenda. Mr. Foster replied that natural attenuation is considered. Work led by Jim Weaver and others in ORD examines how volatile petroleum constituents degrade in soil. This work has been built into the petroleum vapor intrusion model. OEM relies on ORD to provide expertise in this area. There is a research poster on this topic.

Dr. Cervero asked Mr. Foster to clarify his use of the term "contaminant fate." Mr. Foster responded that when fate and transport is discussed within this program, the focus is on examining releases of contaminants into the environment. Research is focused on looking at where a contaminant might go (e.g., if it will get into an aquifer, how fast it will move, what it will adsorb to), if it's going to degrade, and what types of constituents are expected. These physical fate and transport determinations help to form analytical profiles and identify constituents that need toxicity assessment. There is also a biological side to fate and transport, but in terms of environmental fate and transport, the focus is on understanding what happens after the release and where cleanup is needed to protect the environment.

Dr. Richardson asked the members to hold any more specific questions until the OLEM panel later in the agenda.

Successful Partnerships
John Cardarelli II, OEM; Carolyn Hoskinson, OUST

Dr. John Cardarelli thanked ORD for inviting OEM to provide feedback. ORD is critically helpful to the mission of OEM. He categorized the current discussion as the three R's: research, regulations, and response. His presentation will be speaking from the response side. Dr. Cardarelli values ORD because their research impacts the decisions he makes in the field as a responder (his metric). Although he appreciates academic research, he emphasized the value of research that influences responders with decision making on remediation and cleanup that impacts sustainability and the health of the environment.

Dr. Cardarelli described an example of partnership between OLEM and ORD in the response to the Deepwater Horizon oil spill. While he was on the scene, they used EPA's Airborne Spectral Photometric Environmental Collection Technology (ASPECT) to characterize the surface oil concentration so that surface ships could go skim the oil. They worked with the National Oceanic and Atmospheric Administration (NOAA) to determine the areas with the thickest concentrations of oil in order to tell the ships where to go. ASPECT conducted routine, systematic flight paths for data collection to verify modelling performance with aerial and infrared (IR) imaging technology. NOAA needed to understand if the model was reflecting reality. They flew a systematic pattern for over a month. Dr. Cardarelli presented a graph depicting the estimated percent of surface area of the surface oil calculated from IR area imagery. They found that IR light scanner technology was a great way to evaluate surface oil thickness. There was a significant drop in the amount of heavy oil around March 25. They learned later that this was the time period when the initial dispersant was injected into the oil spill. After examining the data with the timeline, they realized that the dispersants worked. However, ORD's research became critical to determine the fate and transport and the effects of dispersant material (longer term issues?). Dr. Cardarelli summed up that that are now circling back to determine research questions related to the fate and transport and dilution factors. He described the spectral analysis of oil (coverage and trend). He mentioned that Captain Tony Zimmer works at the Center Hill facility to identify a new oil simulant that is not harmful to the environment and can be used to test new dispersant techniques, which gets us back to the next "R" (research) and the final R (regulations). He concluded that ORD has had a significant role in their responses.

Ms. Hoskinson began her presentation by saying the UST Program and ORD have had a successful partnership in place for the 10 years she has been with the program. She explained

that when she started in 2006, OUST was researching fuel composition to understand what was in the fuel and what needed to be cleaned up when released into the environment. ORD helped OUST understand fuel composition and what needed to be chased in their cleanup work.

Ms. Hoskinson stated that OUST has worked with ORD on the use of GIS mapping to look at the relationship between the location of USTs and shallow drinking water aquifers. OUST has also worked with ORD to look at site characterization and modeling. Ms. Hoskinson pointed out that the UST program is a fully state-delegated program with the exception of Indian Country. EPA directly implements the program in these areas (which is only 0.4 percent of their regulated universe). For the rest of their regulated universe, the states or territories are the primary implementing agency within their jurisdictions. Field personnel in the states frequently express thanks for the work ORD has done to assist with field-based work.

Ms. Hoskinson shared that OUST and ORD communicate frequently and effectively. They hold a quarterly conference call with colleagues at ORD. This provides a good approach for both sides to catch up on current programmatic issues and for OUST to learn about the research on which ORD is currently working. OUST and ORD find the quarterly meetings to be helpful and a way for them to stay up-to-date. OUST holds a National Tanks Conference every few years and ORD is an important presence at this conference, with ORD providing trainings and some posters at the poster session. The states are appreciative of ORD's role in the program. Ms. Hoskinson concluded that their colleagues in ORD are appreciated as part of the UST program, not just partners, noting there are numerous examples of this relationship.

SHC Overview of Project 3.62, Oil Spills and Leaking Underground Storage Tank Research
Robyn Conmy, ORD; Jim Weaver, ORD

Dr. Conmy, the Project Lead for research project area 3.62, explained that she would discuss the oil spills research and Dr. Weaver, Deputy Project Lead, would discuss the Leaking Underground Storage Tanks (LUST) research. Dr. Conmy explained that many of their close program partners who were heavily involved in this project regrettably could not attend this meeting because they are attending the Annual Clean Gulf Oil Spill Conference.

To put the research in perspective, Dr. Conmy stated that despite the nation's best efforts, there are about 14,000 oil spills each year. There are about 78,000 LUST sites that still require cleanup. It is high priority for the Agency to have research dedicated to these two topics.

Dr. Conmy stated that EPA is responsible for assessing environmental releases of oil from multiple sources, including fuel from leaking underground storage tanks. These releases occur in communities throughout the country, potentially affecting human health and the environment. Project 3.62 is focused on the development of guidance, support for rulemaking activities, and providing technical assistance to a number of program offices including OLEM, OUST, and OW, as well as the regions, states, tribes, other regulatory authorities, response agencies, and the Department of Justice.

Project 3.62 has three tasks: behavior, fate, and effects of oil and spill agents; protocol development for the NCP Product Schedule; and research to support LUST program for both planning and backlog reduction.

ORD's oil research can be subdivided into three areas. The first area is developing approaches for efficient and effective management of oil releases. This includes preparedness, response, and remediation. The second area is to establish the protocols used for NCP products in order to improve regulations and response efforts. The third area is protecting communities from exposures to environmental releases of oils and fuels.

The SHC research program includes three main areas of work: basic research, interagency projects, and emerging research; however, the program is integrated. The basic research portfolio supports the program offices for regulatory decision-making purposes. SHC also does research on emerging issues such as spills of diluted bitumen (including characterization, toxicity, fate and behavior research), and on interagency agreement work. In the last five years, the program has branched out heavily to other federal partners, including NOAA, the Department of the Interior, and the Coast Guard. These projects fit with the mission of EPA and with the nation as a whole. Some examples of this include the development of crude oil simulants (at Center Hill), oil dispersion response tools, wave tank oil droplet modeling, and brine water dispersants. These interagency agreements help ORD to identify future problems that the Agency might face. Currently, SHC is engaged with OLEM on Arctic dispersant use planning. The research will be aimed at determining how well the current dispersant products would work in Arctic brine. At the center of SHC's research program are the Agency's priority needs, which are ever evolving.

Under Task 2 of Project 3.62 (Protocol Development for the NCP Product Schedule), SHC is currently conducting research in three out of the four of those product categories on the NCP. The first is dispersant effectiveness. That program developed the Baffled Flask Test, which is in a proposed rule stage. They are also working on a publication for surface washing agent effectiveness and one for solidifier effectiveness. Dr. Conmy explained that EPA maintains reference oils that are sent out to manufacturers for research purposes, and the stock is dwindling due to Deepwater Horizon and Superstorm Sandy. It is a critical need for OLEM to replace these. SHC has been working with OLEM on chemical characterizations, toxicity testing, and evaluation with existing products to make sure two new reference oils are developed to serve for the next three decades.

Dr. Conmy explained that aquatic toxicity testing as part of the NCP. Research is being conducted on dispersants, surface washing agents, and bioremediation agents in both fresh and salt-water species for coastal and inland oil spills, which is given directly to OLEM.

Under Task 1 of Project 3.62 (Behavior, Fate and Effects of Oil and Spill Agents), SHC is working on dispersed oil plume simulation projects. Dr. Conmy shared that it is important to know how oil behaves in the environment to gain a better understanding of the exposure routes, environmental impacts, and where oil ends up. Since the work they do in the laboratory cannot always be scaled up to the real world, two large research simulation tanks are used. One simulation tank in Canada is 32 meters long, and ORD has a strong partnership with the Canadian government. The other simulation tank is located in New Jersey at the Naval Weapons Station Earle and is 200 meters long. Oil is dispersed into these tanks and the movement and formation of plumes are monitored. Sub-zero releases similar to those that occurred during the Deepwater Horizon blowout can be simulated. These tanks can be used to test SHC's *in situ* sensors and their sensitivity for pH and total petroleum hydrocarbons.

Dr. Conmy showed two videos demonstrating oil droplet size distribution during the tracking of oil plumes in a simulation tank. The first video illustrated what occurs when oil is released into the tank, and the second video illustrated what happens when oil with dispersant is released. The dispersant made smaller droplets that are not as buoyant. Those droplets traveled horizontally in the tank at greater rates than they did vertically. These experiments give SHC information on how oil plumes would behave during a response, and part of their preparedness by helping them to decide which dispersants are most effective for different types of oils.

Dr. Conmy described ORD's work on oil biodegradation. Their work helps determine where oil will go once it is in the environment, if microbes will degrade it, if it will end up in the sediments or if it will all metabolized before it gets that far. ORD discovered that cultures degrade hydrocarbons to different degrees and oil-loving hydrocarbon bacteria degrade oils at different rates. For example, a culture that heavily degrades crude oil may not degrade diluted bitumen ("dilbit"). A significant problem is not knowing if certain materials will degrade.

Dr. Conmy shared that ORD is also conducting research on diluted bitumen and is examining their toxicity, chemical characterization, and biodegradation. All of ORD's results are provided directly to OLEM so they can build up their information on how diluted bitumen behaves. ORD also provides technical support on the oil side, which will be highlighted in the poster session and the demonstrations.

Dr. Weaver provided a brief overview of the history of the LUST Program. The program was created by the 1984 Hazardous and Solid Waste Amendments to the RCRA. The tank upgrade program from 1988 to 1998 required every tank owner to upgrade or replace their existing tanks. As a result of that program, the total number of tanks decreased from approximately 1.5 million to approximately 600,000 tanks that are currently under regulation. The Clean Air Act of 1990 required oxygenated fuels in selected areas. This is what led to the usage of methyl tert-butyl ether (MTBE) in gasoline. Clean air laws that govern gasoline/fuel composition. In 2005, the Energy Policy Act removed the oxygenate requirement in reformulated gasoline, created the Renewable Fuel Standard, and mandated the use of a certain amount of biofuels each year.

Dr. Weaver explained that the UST program has two parts: the prevention and cleanup of UST and LUST. ORD's research funding comes from the LUST trust fund. ORD's work only addresses the cleanup part of the program. An important characteristic of the program is that it is delegated to the states and funded by fuel taxes. Much of the technical support work and interactions occur with the individual states with which they work. States all have different approaches and levels of employees. One way that ORD develops relationships with the states is through the National Tanks Conference. ORD is involved at the conference through workshops, presentations, and organization of the scientific poster sessions.

About 78,000 of the total 600,000 regulated sites still need to be cleaned up. Those are referred to as the "backlog." Some of the backlog sites remain for administrative reasons, while others remain because of technical challenges. The main individual chemicals of concern leaking from the tanks are benzene (carcinogen), toluene, ethylbenzene, xylenes, lead scavengers, MTBE, and ethanol.

Dr. Weaver explained that ORD's research to support LUST focuses on the potential health impacts from contaminated ground water and indoor air (i.e., vapor intrusion). Water from

private domestic wells is a special vulnerability because they are not regulated under the Safe Drinking Water Act. The major exposure pathway is from people drinking from private wells near tank release sites. That has been the historic focus of program. Contaminated indoor air became a concern about 15 years ago. Vapor intrusion is the transport of hazardous chemicals from the subsurface of the ground through building foundations to indoor air. Concern stemmed from a series of articles that appeared in the *Denver Post*. Aerobic biodegradation greatly impacts the potential for petroleum hydrocarbon vapor intrusion since there is a large capacity of oxygen in the atmosphere that can enter the ground and provide the electron receptor needed to degrade the hydrocarbon. There is a limited ability to make direct indoor air measurements. It is technically challenging due to the many sources of indoor air contaminants (e.g., gasoline in the garage). There are also social aspects to consider. Sometimes people do not want their indoor air measured, and EPA does not have the authority to force them. These reasons make it difficult to obtain direct indoor air measurements. This means that suspect or unassessed vapor intrusion may prevent sites from closing, which contributes to the backlog. In these cases, the states do not know how to determine if there is vapor intrusion or not.

Dr. Weaver stated that ORD's research to support LUST has two parts. One part addresses aspects of program planning. Those are issues associated with state-wide assessments and prioritization of sites. ORD is primarily focused on the relationship between private domestic wells and UST or LUST sites. Dr. Weaver mentioned a pilot study they have done in Oklahoma based on census data and well logs reported to the state. The highest reliance on private domestic wells is in a ring surrounding Oklahoma City largely due to expansion of satellite communities without expansion of the water systems. The proximity of USTs to these wells was identified.

Dr. Weaver explained that the second part of ORD's research on this topic is focused on backlog reduction. Some sites remain open because of a lack of understanding of the source of contaminants (i.e., distribution of the liquid gasoline or diesel fuel which remain in a separate phase from the subsurface water). Studies on the following topics are ongoing within SHC: fuel composition; transport from gasoline phases above, within, and below the capillary fringe (ground water transport and vapor Intrusion: Petroleum Vapor Intrusion [PVI] Screen model); and development of modeling approaches to incorporate specific source configurations and uncertainty analysis. Gaining a better understanding of these situations allows the provision of better assessment tools for site managers.

Dr. Weaver shared that ORD also provides technical support and one significant example of this work is ORD's contribution to the development of the PVI Technical Guide. Their contributions include workgroup presentations and discussions, writing and reviewing the document, and targeting research to support the guidance (two of which are support documents for defining vertical and lateral PVI site investigations, EPA600/R-14/318 and EPA600/R-13/047). ORD also developed the PVIScreen Model that addresses vapor transport into buildings.

ORD also provides LUST training to states and tribes. Examples include the Indian Country LUST Cleanup Technical Workgroup; support to individual states (e.g., private wells, chemical analyses, ethanol-gasoline spill impacts, lead scavengers, and remedial measures); corrosion report reviews (e.g., assessment of impact from typical fuel release and LUST site air emission evaluation). Following Dr. Weaver's presentation, Dr. Richardson offered three announcements

leading up to break. Of most interest, he noted that BOSC members will be taking two lab tours, but that there is space available for others to participate.

Poster Session
SHC Principal Investigators and Subcommittee

The subcommittee attended the research poster session then reconvened for the panel discussion to share key observations and related discussions.

Partner Panel Discussion
Will Anderson, OUST; Stiven Foster, OLEM; John Cardarelli II, OEM

Mr. Anderson clarified that Ms. Hoskinson is the Director of OUST and he is the Director of the Cleanup and Revitalization Division. He amplified statements previously made by Ms. Hoskinson, Dr. Weaver, and Mr. Foster. Mr. Anderson emphasized that the Cleanup and Revitalization Division is interested in continuing their relationship with ORD. There is continued interest in new technologies. Part of OLEM's role is to serve as a clearinghouse for information and as a disseminator and creator of technical information. OLEM posts technical documents online, and these resources receive the most online hits and traffic. State programs seek out the technical information and assistance that Dr. Weaver and Dr. Fran Kremer provide. Mr. Anderson added that OLEM is also interested in carbon-based injectates. Carbon injectate is important to states that are using it, but may not be using it correctly.

Dr. Flint shared that one of the posters mentioned that state programs vary in the ways they conceptualize risk related to vapor intrusion and that these issues must be adaptable. Dr. Flint asked if the state variations on risks related to vapors are documented. She inquired about the awareness of trends of interpretation and adaptability of the visualizations. She wondered if these analyses could be developed or if their development would be helpful. Mr. Anderson responded that states set their own cleanup standards. States vary in how they implement a risk-based approach for closing contaminated sites. For some states, if there are no receptors, and thus no risk, sites are not closed and contamination is left in place. Dr. Weaver clarified that states develop screening levels in different ways. Some states use EPA's regional screening levels while other states utilize online calculators or look-up tables. Risk values vary among the different states. Personnel who work for state UST agencies requested the collection of information on risk values from the different states and build this into his software, with feedback on the aggregation of this information being received at a workshop. This, however, would be a labor intensive project.

Mr. Foster wanted to amplify what Mr. Anderson stated. There is great diversity in the range of clients or customers served within OLEM. Implementation of many of the programs, including UST and RCRA, are delegated to the states. Superfund-related implementation is led by federal agencies. Emergency response generally falls under CERCLA authority and most of this work occurs at a federal level, with agencies like the Coast Guard and NOAA providing assistance. OLEM also communicates with local authorities and responders during emergency response events. It is important that OLEM and ORD's products convey science and technology information to a broad audience.

Dr. Cardarelli provided an example from the perspective of a responder. About two weeks ago, Dr. Cardarelli participated in a Vigilant Guard exercise as part of the Emergency Operations

Center (EOC). The exercise included state officials, the local health department, and participants from other local agencies. During the exercise, a software application was implemented that focused on remediation after a nuclear power plant release similar to the Fukushima, Japan disaster. With respect to OLEM's partnership with ORD, Dr. Cardarelli shared that he is constantly in the field explaining that research needs to be applied quickly by decision makers in the field. These decision makers include emergency responders, state officials, and other authorities. His job is to bridge the gap to make those decisions more pertinent. In partnership, whatever OLEM and ORD does must be scientifically sound and legally defensible. These are critical factors to ensuring confidence in decision making.

Mr. Naud shared that the city of Ann Arbor expressed appreciation for VI work and explained he is starting to wonder about VOCs and similar contaminants. There are concerns about BTEX eroding gaskets in water mains, as well as the impact of storm water and sanitary systems on groundwater. There is now a pathway for contamination to surface water. Specifically, National Pollutant Discharge Elimination System (NPDES) permitting programs are starting to worry about these issues. Mr. Naud asked if there has been research priority given to these issues.

Mr. Anderson responded that this is a broad question beyond OUST's primary focus. States have different approaches. For example, Michigan allows for risk-based site closures. Also, research has been done to support California's low-threat approach for site closure. If there is a contaminant found under a roadway, and this area will always be used as a roadway, the site is less likely to be closed. However, various notification processes are used. There are also known compatibility issues with the ethanol in gasoline. A state might close a road, but the impacted infrastructure is under that road. Mr. Anderson stated that he was a bit stumped on this question because these issues are outside of OLEM's research realm. Mr. Naud noted that there are complications because the road might fall under the state's jurisdiction, but the infrastructure under the road is the responsibility of the municipality.

Dr. Martín recalled that Ms. Hoskinson described the relationship between OUST and ORD as successful. He asked if OLEM would also describe the relationship in this manner. Mr. Anderson responded that he would describe the relationship as successful. Mr. Foster added that he would broadly describe the relationship as successful. With respect to the development of the research program and planning process, the program is evolving. The OUST Program has been a successful collaboration with ORD because it is a smaller program. The relationship between the principal investigators and the program is close. However, SHC is a larger program and is still evolving to figure out how best to coordinate their research needs with ORD. While the partnership is successful, OLEM is always looking for ways to improve this collaboration to ensure their needs are being addressed.

Mr. Anderson added that the research timelines are generally long. OUST has tried to complete certain activities yearly. For example, OUST is going to directly engage the states on an annual basis regarding research. Last November, OUST had they first conversation with a state organization, the Association of State and Territorial Solid Waste Management Officials (ASTSWMO). OUST is planning a second meeting with state organizations. This meeting will consist of a webinar highlighting relevant research products that are already available for states. This webinar will be followed by a second conversation to discuss the direction of the research priorities. This will serve as a useful addition to the way OLEM engages with the state programs.

Dr. Cardarelli responded that ORD has been supportive of OEM as illustrated in his specific examples of success. This partnership has made a difference and the outputs have been helpful. However, there have been shortfalls in this partnership because sometimes the resources and expertise are not available to support the needs of those working in the field. This forces OEM to work directly with academia or to complete the work in-house Even though OEM prefers working with ORD. There is an issue with resource competition because ORD has many other customers with other research needs. Research priority is driven by an event that already happened or intelligence of something that might happen. OLEM always wants more research, but the question is whether resources are available for them to conduct the research.

Dr. Martín pointed out that the project charter did not change at all from last year to this year. He asked Mr. Foster if OLEM had any suggested changes to the project charter. Mr. Foster responded that OLEM had the opportunity to comment on the charter, but can't speak to whether or not the charter was changed; that is a question for ORD.

BOSC Subcommittee Discussion
Subcommittee

Dr. Richardson stated that this discussion offers the subcommittee an opportunity to share insights and observations from the posters, presentations, and partner panel discussions.

Dr. Meyer recalled that Mr. Naud raised a question about potential consequences caused by contaminants and damaged water systems. Based on the response from OLEM, it is clear that this particular community need is not being met by this research agenda since it falls under drinking water. There may be other specific municipality needs that are not addressed by this research agenda. Mr. Naud responded that he is not sure if this is a high priority need because of the level of exposure to VOCs. There may be other scenarios where the level of exposure to chemical contaminants is much greater. UST work has fewer available funds, so this is a future looking question. Ultimately cities are going to be burdened with cleanup and environmental exposures from contaminated sites. Municipal concerns may not always reach the federal government.

Mr. Kelly echoed the previous comment about addressing local concerns. He stated that he was happy to hear that OLEM works with states to generate and share research ideas. It is important to look for opportunities to seek this feedback and collaborate with state organizations. States can help identify research needs. With respect to vapor intrusion, it is critical to explain why some contaminated sites are investigated and others are not. OLEM should utilize a predictive model and explain why this work takes a long time to complete. OLEM needs to work with the citizens and these citizens want answers.

Dr. Nance shared that her work is focused in participatory research and she noticed a few things missing from the research presented during today's discussions and poster session. Many of these missing elements occur before and after research. Before research, there should be signs that voices from the communities are considered. Dr. Nance said that better representation of the community voice is needed, and this was not visible across the projects. Community input is missing. After the research is presented, the technical work must be translated effectively to the community so they can engage and take ownership of the work and use it in their own documents and applications. Dr. Nance did not see the translation for community partners and

acknowledgement that this issue was important. Dr. Weaver responded that sites are managed by the states or the EPA regions (on tribal lands). ORD works with states and regions whose protocols involve community engagement activities, with each state having different activities. Thus, ORD is a step removed from the site managers communicating with the actual people living in the community. Dr. Weaver supported attendance at public meetings to explain to the local community how ORD's work is being used. However, with the way the sites are managed, ORD is one step removed from direct communication with the people in that community.

Dr. Rubin pointed out that the subcommittee did not hear anything about which communities are specifically affected. In North Carolina, many communities are using well water potentially contaminated with bacteria, metals, and other toxics. As municipalities grew around them, they were left out of the distribution of water from natural reservoirs. Dr. Rubin emphasized the importance of looking at the vulnerability of communities. He asked for more information about how many vulnerable communities were considered.

Dr. Flint recalled that there was information on the posters and in the materials about private wells and the use of census data in conjunction with state data. She wondered about the quality of these data and tracking private wells in certain parts of the country. Dr. Flint requested more discussion on potential issues with data accuracy brought about by the use of external data sources.

Mr. Naud shared that there is an online well viewer in Michigan, and there are big data gaps in Michigan. However, if the well is older, only a file with a hand-drawn diagram is available versus the online applet. There has been no effort to digitize older data and there could be issues with these data.

Dr. Weaver agreed that data quality is a huge issue. OLEM has a paper coming out that incorporates census data. From 1916 to 1990, the census asked if participants obtained their drinking water from a private well or a public water source. The data from 1990 were used as the baseline, and data was projected forward using two methods. One method is using well logs reported to the state. This can be limited because states do not report at the same rates and well drillers did not submit their logs as they were supposed to. Thus, these data have error associated with them. Another method is using housing units and relies purely on census data. Both methods have limitations, but the goal is to find areas with a high reliance on private wells rather than to identify specific wells. Quality tests have been performed on the data.

Dr. Cervero stated that he was struck that the focus of the research program was on the contemporary context and recent history. It is unclear to what extent the program is future casting to 10-15 years out. It is not clear that issues such as climate change, salt water intrusion, rising sea levels and the impact on drinking water, or fundamental shifts related to climate and their effect on drinking water are being considered. These issues would impact coastal areas. Dr. Richardson agreed that this was a good point to raise as one of the charge questions is focused on anticipating future problems that effect long-term sustainability. Mr. Foster responded that OLEM is limited in what their research program can address. He explained that EPA remains somewhat siloed, with OW and its ORD research program addressing most drinking water-related issues and larger issues related to water quality, not OLEM. OLEM is focused on environmental releases from leaking USTs and statutes related to those issues.

Dr. Geller shared that Dr. Weaver has done substantial work on the erosion caused by fuel additives. The issues raised by Dr. Cervero might cross the national research programs. The Safe and Sustainable Water Resources (SSWR) research program is focused on water infrastructure. However, if water infrastructure is impacted by reformulated fuels, then this issue could be prioritized and considered within the SHC program. ORD can lead the breaking down of this silo. Dr. Weaver noted that there are some intersections within the SHC and SSWR Programs, such as issues related to the impact of USTs on drinking water. Many presentations on the remediation of contaminated sites end where the property boundary meets the road and contaminants under the road do not get cleaned up. Dr. Cervero added that parking lots in the suburbs create a huge pavement footprint. This footprint is impacted by contaminant (e.g., oil-stained, creosote) runoff from privately owned impervious surfaces as well as the municipal road network.

Mr. Naud added that storm water runoff provides another potential area of intersection. In Ann Arbor, there has been a 44 percent increase in precipitation over the past 60 years, which created more storm water runoff. Storm water must be infiltrated into sandy soils. The city could be advising that water be pushed into the ground, thereby introducing contaminants. There could be pressure from NPDES about holding storm water and keeping it out of the surface water. Neither Ann Arbor nor Michigan have an answer to this issue.

Dr. Richardson asked if the subcommittee wanted to share observations and insights gained from interactions with ORD scientists.

Dr. Tharakan responded that he liked the content and organization of the research project posters. Since this is sustainable and healthy communities research program, however, he thought that the posters could benefit from including more information on the social impact of the project and how the research results could be translated to make a visible difference in communities.

Dr. Meyer referred to the poster on the development of the NCP protocol. The poster described accomplishments and the last in this list was the dissemination of research findings. Dr. Meyer observed that the research findings might be disseminated, but it is unclear if they are being used on the ground by the parties that need the science so individuals can act more appropriately. Dr. Meyer clarified that this is not the mission of SHC, and he is not sure where this fits in to the current silos at EPA. However, the program needs to go beyond disseminating information and also determine how individuals use and apply the information. Specifically, it is important to consider how a small municipality can apply the science.

Dr. Conmy responded that for the NCP protocol, the end user is the public, but there is a big intermediary step. Data is published and the findings are reported to the program office. ORD and the program office then provide the National Response Team and the federal OSCs with this data. The data are then incorporated into the area contingency plan for each region. Dr. Conmy provided an example of implementing data on the efficacy and toxicity of dispersants during a spill. These data allow for the use of the most appropriate dispersant in a given scenario and communities know which dispersant to stockpile. Translation is focused on ensuring that a community knows the best product to use during an event. She clarified that research findings do not stop with publications and continue when they are translated and incorporated into actions at the regional level. It is important for research to be used by responders on the ground. Dr. Flint asked if there was a mechanism for incorporating feedback and lessons learned from OSCs and

other personnel on the ground so it can feed back in to the findings. Dr. Conmy responded that this process would be a large undertaking, involves what the region elects to supply back to ORD and beyond ORD's control thus, there is currently nothing written that helps guide that process. Feedback is received organically, but this type of formal feedback activity is outside of ORD's current budget. Feedback is provided by the regions or supplied through the program office.

Dr. Dannenberg proposed conducting, for a finite cost, an evaluation of the translation, implementation, and use of research where those direct findings had an impact and what were their characteristics and other factors. This evaluation would provide insight on which projects are making a difference.

Dr. Tharakan asked if there was a method for users to provide feedback in terms of how well the product is working and assessing user implementation of research protocols and other products. ORD does the science, develops a protocol, and publishes it with the intention that it will be used by specific groups. An approach is needed for assessing the use of research products. Dr. Conmy replied that ORD works with the program office to refine the protocol and ensure that it meets OLEM needs. After round-robin testing and reproducibility studies, ORD assists OLEM with drafting language for the 40 CFR for the federal docket. The protocols are then issued for 90-day public comment. OLEM addresses all public comments and revises the protocol accordingly. This is a multi-year undertaking. There are several steps involved in this process. ORD is committed to only putting forward protocols that are robust and scientifically sound. Which reference oils are selected, however, is a very different story.

Visit ORD Laboratories in AWBERC
Cindy Sonich-Mullin, ORD; Subcommittee

Dr. Cindy Sonich-Mullin welcomed the subcommittee members and explained that they would hear about two projects. The first was on oil spills, which would be presented by Dr. Robyn Conmy, and the second was on the analytic laboratory for contaminants of emerging concern for the Great Lakes National Program Office (GLNPO) and Superfund contaminated sediments, which would be presented by Dr. Marc Mills. Ms. Mya Sjogren explained the laboratory tour procedures and safety protocol before the laboratory project presentations commenced.

Oil Spills - Dr. Robyn Conmy

Dr. Conmy presented her work on the behavior, fate, and effect of oil and spill agents and the wave tank oil plume simulations under Project 3.62.

Subcommittee Question and Answers

Mr. Steinhoff noted the potential for dispersants to make oil more bioavailable and asked what oil components were left over after treatment with dispersants. Dr. Conmy explained that oil is readily degraded by microbes, and dispersants accelerate this process. Longer fate of oil and dispersants are the recalcitrant components. The dispersants that are authorized for use during a spill tend to have low toxicity as per the NCP protocols

Dr. Dannenberg asked if smaller particles were better for fish and other ecological receptors. Dr. Conmy explained that NOAA was spearheading a project to evaluate toxicity testing, explaining that they were looking at the particle size effect in approximately forty oceans species. She

further explained that they are testing a range of concentrations, oil alone, oil-dispersant mixtures, and dispersant alone.

Dr. Tharakan asked if the oil dispersants were commercially available. Dr. Conmy explained that ORD only tests commercially available dispersants listed on the NCP. Currently there are two types stockpiled even though several are included on list (Subpart J of the NCP). NHEERL provide expertise within ORD for testing toxicity of:

- Bioremediation agents;
- Surface washing agents; and
- Dispersants.

Dr. Nance asked who conducted the community outreach efforts. Dr. Conmy explained that her research team does not typically conduct outreach to communities. The program exists from direct appropriation from the Oil Spill Liability Trust Fund through the Oil Pollution Act of 1990. The trust fund monies that come to the ORD are designed to provide technical support to OLEM, a relationship that predates SHC. In fact, our program is aligned not just with SHC, but also the priorities of SSWR, ACE and Homeland Security research programs due to the nature of our interdisciplinary work. That being said, on occasion there are opportunities for our program to engage with the public for informational purposes that is coordinated at a Regional level, such as spill preparedness workshops that include local stakeholders (county officials) and community (e.g. fishermen).

Dr. Cervero questioned whether the focus is oil spills on land? Dr. Conmy clarified that currently her program does more research on spills on water. That is because spills on land are typically quick responses where the oil can be contained easily. These are handled at the Regional level. Spills on water are more difficult to contain and can remain in the environment over longer periods of time and thus, require research into the fate and transport of oils.

Analytic Laboratory for Contaminants of Emerging Concern and Great Lakes National Program Office and Superfund Contaminated Sediments

Dr. Marc Mills presented his research on the remediation to restoration to revitalization approach (R2R2R) for the Great Lake areas of concern, including the methodologies, metrics, and indicators developed in his project.

Dr. Mills explained that he used the analytic laboratory to investigate contaminants of emerging concern in sediments for GLNPO and the Superfund Program. The project began in 2006 when Dr. Mills first purchased his laboratory equipment. He explained that the project aimed to investigate the methods for analyzing perfluorooctanoic acid and perfluorooctanesulfonic acid beyond drinking water to examine contaminated sediments. Dr. Mills explained one of the project objectives was to assess risk management and remediation strategies at contaminated sediment sites and noted that some of the precursors prior to undergoing remediation processes could be volatile and unstable but could also be more important than the end products.

Dr. Mills explained that the researchers recently added an outline to the sediment evaluation process and measured the sediment particle diameter at the part per trillion level. He added that the Cape Cod, Massachusetts samples, which included samples from 73 coolers, took about 1 week to process. He described the mass spectrometry analytical laboratory is used to investigate

contaminants of emerging concern (CECs) and stable isotopes for the Great Lakes National Program Office & Superfund contaminated sites. The analytical laboratory was established in 2004 with purchased LC-MS instrument funded by OW to look at CECs. One high-profile project is investigating per- and polyfluorinated alkyl substances (PFAS) such as PFOA and PFOS. They are developing analytical methods beyond the drinking water method so they can evaluate fate and remediation strategies. Precursors, which may be volatile and unstable, may be just as important than the stable end products (e.g., PFOA and PFOS). Dr. Mills noted that he recently added an online solid phase extraction device to lower sample volume requirements and improve sensitivity. Currently they typically measure CECs at part per **trillion** (ppt) level, with samples taking about one week (Cape Cod example of 73 coolers could be reduced with online solid phase extraction).

The second side of the laboratory—the stable isotope laboratory—was established in 1997 when he started his postdoc. Dr. Mills explained that naturally occurring carbon, nitrogen, and oxygen isotopes (naturally occurring) were measured in the contaminated sediments, food webs, and tracing water. Trace carbon is used to determine where, for example, PCBs are being introduced into the food web and help to inform EPA's fish consumption advisories. He explained that his researchers were also measuring the changes in contaminant concentrations in organisms at various levels of the food web after remedial efforts. For example, researchers were measuring the contaminant concentrations in fish tissue as well as in tissue samples from some of their food sources, such as spiders and macroinvertebrates. Dr. Mills concluded his presentation by noting that some of his current efforts were focused on determining the connections between contaminant concentrations in the food web (i.e., sediments, aquatic insects, spiders, fish, etc.).

Subcommittee Questions and Answers

One subcommittee member asked Dr. Mills if he was also looking at livestock. Dr. Mills explained that he was not, but he was currently investigating the uptake of contaminants (i.e., PFAS) into the shoots of corn, lettuce, and other edible plants, but not specifically livestock. Dr. Rubin asked about the work Dr. Mills did in Cape Cod, Massachusetts, and why study? Dr. Mills explained that it is a community that is currently highly dependent on septic systems, but is converting to centralized treatment. The geology/soil type at Cape Code is highly conductive so whatever gets into ground is quickly transported to the aquifer and subsequently daylights in surface water.

Dr. Nance asked Dr. Mills if he had examples of instances where his laboratory's contributions led to a change in a fish consumption advisory. Dr. Mills explained that his research is not as much focused on surveys/discovery of contamination, but focuses on research to determine whether contaminated sediments remediation is operating properly such that Advisory can be reduced (two fish/month) or removed.

Dr. Cervero noted "Discovery" is being conducted in some ORD's laboratories (e.g., NERL RTP is conducting research on untargeted analysis for discovery of new fluorinated compounds). Dr. Flint asked Dr. Mills if he was considering doing similar work on spray irrigation. Dr. Mills explained that some of his CEC work supports SHC and CSS, but much of his work supported SSWR, including his work on source drinking water. He added that, because ORD's work is not as siloed as the work done by the program offices, he is able to work on projects that inform

multiple ORD research programs. Dr. Tharakan asked if the sediment contaminants moved up the food chain. Dr. Mills explained that his research started at the top of the food chain and was working down to the bottom. Sport fish and fish for human consumption tend to be the top of the food chain and may take 10-20 years to show in decline in contaminant levels due to a restoration project. Dr. Mills added that he started with these top predators, but are working down to evaluate lower food web species for balance response time versus data and variability.

Introduction to Tour of Center Hill Facility
Subcommittee

Dr. Geller shared with the subcommittee tour information provided by Mr. Dave Carson. The Center Hill Facility was created in response to the need for industrial sized research facilities so Dr. Geller noted that the subcommittee would be able to observe the facility's ability to scale up. Dr. Geller provided examples of scalability, including the application of laboratory leaching tests from coal ash to real-world situations (e.g., leaching from roadway contamination) and the large columns in the facility used for testing the beneficial use of materials in various conditions (e.g., changing pH or salinity in water). He added that testing the beneficial use of materials at a larger scale allowed for the discovery of unanticipated consequences, which prevented various material reuse applications from producing deleterious impacts in the field.

Dr. Geller explained that Center Hill researchers were frequent contributors to the engineering, technical support, and regional technical liaisons for applying technical solutions. The researchers often worked with regional staff through the regional partnership program, which ORD referred to as R2P2. Center Hill also served as the inner-agency link to the United States Department of Energy's advanced proton source and Argon National Laboratory near Chicago, Illinois. Dr. Geller explained that, with this agreement, EPA was part of the materials resource collaborative access team at Argon, which was used to identify types of metallic contaminants in environmental media and apply nanomaterial fundamental characterization in targeted technical solutions to real-world contamination situations.

Dr. Geller explained that scientists working on bioavailability and bioaccessibility were currently working with NERL and NHEERL to simulate gastric juice to determine the amount of metals (e.g., cadmium, lead, mercury, and arsenic) that were bioaccessible in soil when ingested and if phosphate or other additives could bind to those metals to reduce bioaccessibility. He further explained the number of real-world scenarios that this work applied to, including the numerous residential areas that used to farm with arsenides.

Researchers at Center Hill utilized bench-scale research laboratories for initial phases of work before scaling-up to pilot research, followed by field deployment and application research. High levels of data quality were achieved at the facility during all phases of research and development. Dr. Geller explained that during the tour, the subcommittee would learn about two research topics. The first was on soil leaching processes, which would be presented by Dr. Souhail Al-Abed, and the second project was on oil spill simulant development, which would be presented by Dr. Tony Zimmer.

On behalf of Mr. Carson, Dr. Geller thanked the subcommittee for coming to Center Hill and noted that the scientists were eager to share their research with the BOSC.

Subcommittee Questions and Answers

Ms. Sjogren asked which SHC research topics the two Center Hill projects fit into and Dr. Geller explained that the oil spill simulate research would fit under Project 3.62. However, the soil leaching processes research could fit under Project 3.61 or Project 3.63 so he suggested confirming his response with Dr. Al-Abed.

Dr. Geller described Dr. Al-Abed's work, which included looking at the use of crab shells (i.e., mesoporous materials) as a way for passive treatment of mine wastewater. He explained how the lime rich calcium carbonate crab shells could neutralize the acidified mine waste water and how the shells contained sulfur compounds that could bind to and neutralize metal contaminants. He added that Dr. Al-Abed's preliminary results showed some of the materials as potentially great for remediating mine waste issue. Dr. Geller added that Dr. Mills was also working on using locally sourced agricultural or timber waste to produce anaerobic "biochar" that could be used to hold water in soil or for remediating contaminated sites. Dr. Geller noted that ORCR was not interested in the biochar work because they did not regulate agricultural waste. However, the Office of Superfund Remediation and Technology Innovation (OSRTI) was interested in this research because they could use the biochar to remediate contaminated sites. Dr. Geller added that the use of waste materials as a feedstock to address a number of issues, including carbon sequestration, groundwater contamination, and remediation, was very compelling.

Tour Center Hill Facility
Subcommittee

Mr. Carson welcomed the subcommittee to the Center Hill Facility. He explained that he was the Branch Chief of the facility and introduced Dr. Al-Abed and Dr. Zimmer, who would be providing the research presentations. Mr. Carson noted that the Center Hill Facility had been around for a long time and reviewed the facility's safety items, including the use of safety glasses. He added that there was no radioactive research taking place in Laboratory 131A despite the sign.

Mr. Carson explained that the Center Hill Facility was part of EPA's land management space and they conducted ORD risk management research. He added that the facility was one of nine laboratories, and this facility focused on how materials interact with soil and environmental media. He commented that the laboratory's clients included the EPA program offices, regions, the regional technical support centers, and states. The location of the facility allowed the majority of research and applications to be tested in-house, which kept data quality high, and this research was often done in collaboration across laboratories and with external partners.

Mr. Carson explained how their work impacted communities. Specifically, the focus of their research was in applied research, which required working closely with communities and municipalities. The Center Hill Facility scientists often shared their research with stakeholders through tools, publications, and applied research support centers. Mr. Carson noted that the subcommittee would hear from some of the facility partners tomorrow morning and then opened up the discussion to questions. Hearing none, Ms. Sjogren divided the subcommittee into two groups and started the laboratory tour.

Oil Spill Simulant Research – Dr. Tony Zimmer

Dr. Zimmer welcomed the subcommittee and noted that he would be explaining his research on what happens to water droplets in the water column. The Deep Water Horizon oil spill incident

highlighted the knowledge gaps in the understanding of fate and transport of oil dispersants. Dr. Zimmer explained that the Department of the Interior put out a call to examine oil simulants, which at that time included dog food, coffee beans, and peat moss, all of which were not great simulants.

One of the leading oil spill researchers asked Dr. Zimmer to use his expertise in aerosol physics to generate an oil simulant. Dr. Zimmer explained that examination of aerosol routes, titanium dioxides in pigments, and materials from microscales to nanoscales highlighted the fact that aerosol synthesis was where production of oil simulants could be found. He added that the aerosol synthesis processes were scalable and it was easy to move from one to fifty processes running in parallel.

He explained the basic idea behind the oil simulants process. The process began with fluorescence salt, which is used all the time in titration and open water studies. The fluorescence salt began the process as a red color but fluoresced when put into dilution. However, the issue with using salt was that it dissolved in water so the salt had to be put through an electrospray.

Dr. Zimmer explained that an electrospray was chosen for synthesis of the core because of its tune-ability. An electrospray is used in nanomaterials production and biomedical applications so it is able to look at orders of magnitude shifts, which provides the precision needed for the oil simulant process. Dr. Zimmer explained how the electrospray worked; the electrospray created a voltage difference and when the voltage reached two kilovolts, the electrospray produced a tailored cone, which in turn produced pore-forced particles. Those c-particles then went into a furnace with carnauba wax and mixed with the wax vapors. Once the mixing occurred, the thermodynamically favorable state was no longer vapor and the mixture formed a porous shell solid formation.

Dr. Zimmer explained the process of impingement. He explained how the process allowed the aerosol to be put into solution, which needed to occur in order to be able to see what was happening in the experiment. He added that the researchers conducted many experiments to determine the optimal process and were initially concerned with the preliminary results because the volume concentration of their oil simulate was small compared to the fluid; the oil simulant averaged 1 to 3 parts per billion or 250,000,000 particles per cubic centimeter. However, Dr. Zimmer explained that the researchers later found the volume was acceptable from a math perspective.

Dr. Zimmer explained that the oil simulant process was quite successful. The excitation emission matrices (EEMS) analysis provided a very characteristic oil footprint or signature that could be used to identify where the oil in spills came from. He explained that researchers were now using fluorometers to identify oil and the tool could distinguish between the fluorescence and the other fluorescents in the mixture. Dr. Zimmer noted that the research team recently gave a presentation on their findings to an interagency group of EPA staff and NOAA. He added that his research team was in the process of securing their next round of funding to scale and optimize the process. Dr. Zimmer then opened up the discussion to questions.

Subcommittee Questions and Answers

Dr. Tharakan asked what Dr. Zimmer meant by “scaling the process.” Dr. Zimmer explained that the project was going from milligrams to kilograms. He was also working on a dual capillary

process and developing sugars for oil simulates. However, not much was known about oil simulates so the hope was that this research would provide insight into real-world scenarios so that first responders would know what they were dealing with and how to respond to spills.

Dr. Tharakan then asked why oil simulants were being used in Dr. Zimmer's closed experiments in the laboratory rather than oil. Dr. Zimmer explained that it was not required that oil simulants be used because their research was being conducted in a closed system. However, in terms of particle transport, oil simulates allowed for fine tuning (i.e., they could be tweaked before being used in an experiment) which was helpful. Also, oil simulants could be used as tracers in oil spills, like the Deep Water Horizon, which could help locate a plume in the field.

One subcommittee member asked how long a simulant was active. Dr. Zimmer explained that it depended on the microbial life. Oil was food for some bacteria so the experiments were conducted under the assumption that the oil would be consumed.

Dr. Tharakan asked if the simulants had been compared to oil, and Dr. Zimmer responded that comparing the two was the next step for the research.

Dr. Meyer asked how the project was being scaled and if the oil simulants were tested in different water salinities. Dr. Zimmer responded that the projects were conducting experiments at different scales and salinities.

Soil Leaching Processes – Dr. Souhail Al-Abed

Dr. Al-Abed presented his research on materials and material management. He noted that this research was focused on reusing waste material to treat acidic mine wastewater, which was pertinent research to communities. He noted that waste materials could either be put in a landfill or used for a different purpose. Dr. Al-Abed explained a fact sheet that displayed a ball of solid material that was used to remediate metals (e.g., lead, arsenic, and mercury) by providing several compartments where the metals could bind to various materials, such as silica or iron oxides. He added that once the metals were bound to the solid material, it became waste that could either be disposed of or reused. However, repurposing the waste material required that the new purpose would not harm human health or the environment, which required the consideration and determination of how the material could change after it had been used in various processes.

Dr. Al-Abed reviewed several tests that ORD used to help them determine how a material could change when used in various process. One test was the toxicity characteristic leaching procedure (TCLP) that spun the material in a solution of acetic acid for 18 hours to simulate what would occur in a landfill. Dr. Al-Abed explained that the solid material was placed in the liquid and the end result was analyzed to determine if the end product contained compounds that exceeded any limits that could harm human health or the environment. If those levels were exceeded, then the solid material was considered hazardous waste and had to be treated before going to a landfill. Dr. Al-Abed noted that the material tests went much further than the TCLP test before explaining the second test that examined liquid saturation. The test used varying amounts of material in the same amount of solution to determine the material's liquid saturation. The third test examined the diffusion of materials and the fourth test looked at the variability of pH and liquid solubility. The variability of pH and liquid solubility test determined the buffering capacity of the material being tested (i.e., the ability for the material to change the pH of a liquid) and the ability for the material to reduce the oxygen, all of which could occur in a disposal scenario.

Dr. Al-Abed explained some of the various uses of waste materials. For example, mollusk shells were used to remove acid mine drainage. He noted that there were five hundred thousand abandoned mines west of the Mississippi and explained how running the acid mine drainage over the mollusks shells could treat the waste water. The shells treated the water in a number of ways, including by acting as an absorbent, precipitating out the metals, and providing a surface for sulfate-reducing bacteria to grow. Dr. Al-Abed noted that the sulfate-reducing bacteria used electron donation to reduce sulfuric acid into sulfide, which was much more stable and less harmful to the environment. Dr. Al-Abed concluded his presentation by noting that this research could use local waste materials, such as woodchips, walnut shells, or horse manure, to treat acid mine drainage.

Subcommittee Questions and Answers

Dr. Tharakan asked how the materials were used in remediation. Dr. Al-Abed explained that the materials were covered with alternative taps, which meant that the materials were mixed with native soil and native plants were then planted in that soil. The metals from acid mine drainage were either contained in the plants or converted into a more stable state and explained that metals could be regenerated but could not be destroyed. However, he added that this method required no energy or maintenance after the trench was put into the remediation site, which was outstanding compared to other treatment processes.

Dr. Irwin asked how fast the process worked. Dr. Al-Abed responded that it depended on the material. The mollusk shells took two months to treat water in one experiment that had a pH of 2.5 and contained zinc and copper. The shells were also able to treat the water for a long time compared to other remediation materials, such as woodchips.

Dr. Martín asked about off gassing and Dr. Al-Abed explained that off gassing occurred, but not much gas was produced.

Dr. Tharakan asked if the project was still in the research phase or not. Dr. Al-Abed explained that there were a few pilot projects in various communities and added that this work was particularly important to tribal communities that relied on fishing for sustenance. He elaborated that those communities had the mollusk shell waste readily available to treat contaminated water and added that the research was also looking into redox reactions.

Dr. Al-Abed explained the upscale engineering project that used a switch-back apparatus with a downhill slope and acid mine drainage from Oregon (Region 10) to determine the retention time required to treat contaminated water. He added that this treatment system would also require no energy or maintenance once it was installed and could use a variety of local waste materials from various regions.

Return to AWBERC, Wrap-up, and Adjourn
Robert Richardson, Chair; Jace Cujé, DFO

The subcommittee members returned to the AWBERC, and Dr. Flint adjourned the first day of the SHC subcommittee meeting.

Thursday, November 3, 2016

Opening
Jace Cujé, DFO; Andrew Geller, NPD

Mr. Cujé welcomed the participants to the second day of the meeting. He applauded the great science presented at yesterday's meeting and during the two site tours.

Mr. Cujé shared that Dr. Richardson had a family emergency and will not be able to participate in the remainder of the meeting. Dr. Flint, the Vice-Chair, will lead the meeting in Dr. Richardson's absence, which is in accordance with FACA provisions.

Dr. Geller thanked the participants for their attendance. He introduced Mike Slimak, who was recruited to help with the National Center of Environmental Assessment (NCEA) when its Director retired. He thanked Dr. Slimak for his service to NCEA.

Dr. Geller then introduced Ms. Mya Sjogren and Ms. Melissa McCullough, as key members of the SHC team, as well as Ms. Sarah Mazur the Deputy Associate Director and Ms. Karen Chu as SHC's Senior Communication Director. He also noted that Ms. Mazur, Ms. McCullough, and Ms. Chu will be leading Partner Alliance and Coordination Teams (PACTs) to enhance communication between SHC, OLEM, and other EPA partners.

Yesterday, we talked about the challenge of research translation and developing language that we all share.

Dr. Flint thanked the attendees for their participation. She noted that the subcommittee would begin drafting their responses to the charge questions tomorrow and that the entire subcommittee would participate in this process. She envisioned dividing into small groups based on areas of expertise and focus, requesting that Mike Steinhoff and Drs. Tharakan, Martín, and Dannenberg pay particular attention during SHC 3.63 (SMM), while Jim Kelly and Drs. Rubin, Irwin and Cervero should focus on this afternoon's sessions regarding contaminated sites.

Program and Regional Office Overview of Research Needs
Tim Taylor, OLEM

Mr. Taylor stated that he was glad he attended yesterday's session so he could hear the information being offered and the subcommittee's questions and comments. He shared several topics that resonated with him from yesterday's discussion. These topics included land use options and economics, particularly focusing on options as they relate to RCRA, fate and transport modeling, risk assessment, producing scientifically sound and legally defensible science. States vary in how they conceptualize risk and their levels of expertise on the subject. Non-hazardous wastes have been delegated to the states under RCRA. Measuring the utility of ORD's tools and products is important. These products need to reflect the wide diversity of OLEM's clients and do they incorporate consideration of climate change. Mr. Taylor noted the three R's were discussed yesterday: Regulations, Research, and Response resonated as well since they are a reality of RCRA. No matter how much OLEM transitions to SMM, his office is still authorized under RCRA and OLEM has specific responsibilities because of that law.

Mr. Taylor shared that, in the beginning of RCRA, EPA evaluated all industrial wastes and determined if it were hazardous because they were specifically listed whereas, others were hazardous wastes since they exhibited hazardous characteristics. Hazardous wastes are the responsibility of EPA, but non-hazardous wastes are the responsibility of the states. There has

been a movement from safe disposal to reduce, reuse, and recycle. Responsibilities related to these wastes were delegated and the federal government supports states and communities in determining what to do with this waste.

Mr. Taylor described the strategic plan for the SMM Program. The objectives of the strategic plan include decreasing the disposal rate, reducing the environmental impact, increasing socio-economic benefits, and increasing state and local capacity. Strategic priorities include the built environment, sustainable food management, and sustainable packaging and how can we use them, modify them, etc. to reduce environmental impacts. Other emphasis areas include life-cycle assessment (LCA) and international efforts, sustainable electronics management, and overarching measurement efforts. Mr. Taylor noted that OLEM often does not have the necessary data on the amount of waste generated and a method for tracking this data.

Mr. Taylor described research priorities of the SMM Program, including regulatory support, LCA, multi-media modeling, and data tracking methods. He noted the shift from disposal to alternative options keeping in mind the programs that are delegated. Mr. Taylor stated that it always boils down to data. Some of this data is new data on what happens to waste, behaviors, and performance of various disposal mechanisms. There have also been shifts and needs have changed. For example, certain materials might be acceptable for landfilling, but not for land application or as a soil amendment. A different method for disposal may be needed based on the end use. Mr. Taylor added that data and models need to be updated. Some models are used regularly in regulatory support decisions that include databases that have not been updated since the 1990s. Improved coordination of data is also needed. Open LCA is one area where improvements are needed. ORD has been working to make sure that EPA's data conforms to international standards so that the data can be used by all groups. Data feed into models and the models inform decisions. OLEM is helping the states and communities in these ways.

Dr. Martín pointed out that Mr. Taylor glossed over tracking methods as a research priority. He asked for clarification on the meaning of this research priority. Mr. Taylor provided the example of determining what to measure and how to collect data related to construction and demolition (C&D) debris. A protocol was developed for what to sample and how to measure in order to track waste generation, movement, and the reuse of these materials.

Successful Partnerships
Nickie DiForte, Region 2; Tim Taylor, OLEM

Ms. DiForte shared that Region 2 and OLEM partnered on a project on the management of wood materials from site clearing and storm debris. This research was funded by ORD and the research team included representation from ORD, OLEM, and Region 2. Wood materials need to be managed at almost every Superfund site. Natural disasters, such as Superstorm Sandy, can also generate large amounts of woody materials and plant debris.

After highlighting R2 examples, she noted the Superfund program's increased focus on the environmental footprint of cleanup through OLEM's Green Remediation policy, Superfund's Green Remediation strategy, and individual green remediation policies such as R2's "Clean and Green Policy" resulted in identifying best management practices for many materials found on-site and highlighted the need to evaluate the impacts of different alternatives for wood materials management.

Ms. DiForte continued by noting that the available options for managing wood materials present conflicting results with respect to measuring environmental impacts. Trees sequester carbon and landfilling trees causes them to decay much slower than other management methods such as chipping or mulching. Region 2 recognized that this issue was broader than site remediation. Many of the personnel involved in addressing these issues are part of the net zero community and prefer options that minimize waste.

Ms. DiForte reported that Region 2 developed a guide to assist decision makers in evaluating a variety of wood management options considering multiple criteria including LCA information and data from existing literature to help identify tradeoffs between options. The guide includes the results of a literature search that identified options for wood management and data characterizing the cost and environmental aspects of the options. The literature searches revealed gaps in the research. The guide also includes a flow chart and checklist to assist decision makers while making choices for a variety of wood management scenarios. The decision matrix includes symbols to represent best, good, and worst options for wood management. The overall score incorporates weighted and unweighted rankings. Approaches are provided to combine information from the flow chart. Also provided in the guide is a list of facilities in Region 2 that are candidates for accepting large volumes of wood wastes.

Ms. DiForte shared that the project report *Management of Wood from Site Clearing and Storm Debris* is under review and will be finalized. Next steps include identifying further research needed to better understand the parameters for decision making related to the management of wood materials.

Ms. DiForte presented a case study of a contaminated Superfund site in New Jersey that is heavily wooded. There are planned soil removal and cleanup operations. The first step was to characterize the site and wood generation. The second step is to characterize wood management options. During the next step, the cost, environmental impact, and other aspects of wood management options are assessed. Local end users were contacted to determine the cost and revenue potential per ton as well as the net cost per ton. Using this information, wood management options can be evaluated during the fourth step.

Mr. Taylor noted that there are partnerships between OLEM and ORD to improve and update models. For example, ORD assisted ORCR with updates to models including the WARM model and Hydrologic Evaluation of Landfill Performance (HELP) model. Users of the WARM model requested that it be updated to include more factors than just consideration of greenhouse gases so a major motivator was what ORCR was hearing from states. Although the HELP model is challenging to use, it is the only model available for this analysis. ORD tracks the number of downloads to measure if people find the model useful, and it appears that the model is being used despite its challenges. ORD is currently updating the model.

Mr. Taylor noted that climate adaptation resilience is being considered within the context of the built environment, specifically in relation to building codes. Climate change and health are both being incorporated into products from OLEM and ORD.

Mr. Taylor added another topic he heard during yesterday's discussion is that there has been a longstanding successful relationship between the UST Program and ORD because the groups work together frequently. OLEM has applied this approach in other components of SMM. For example, ORD sat down with OLEM to better understand ORCR's needs and modified the

project scopes of three existing products to satisfy six of SMM's research needs, which ORCR views as a success. In closing, Mr. Taylor stated that OLEM also works regularly with ORD to develop risk-informed materials management and multi-media models.

SHC Overview for Project 3.63, Sustainable Materials Management (SMM)
Thabet Tolaymat, ORD

Dr. Tolaymat introduced himself as the leader of the project team for SHC project area 3.63: SMM. The focus of these projects is to develop approaches for SMM and to reduce the impact of materials on public health and the environment. Dr. Tolaymat explained a challenge that he faced when developing the project plan was looking forward and moving the science forward while not forgetting the legacy of years of solid waste management research. To accomplish this, his team met with ORCR to better understand its research priority needs. Dr. Tolaymat described how on-going research was adjusted to address future research needs. Explained that the project plan is sub-divided into four separate tasks. These project tasks include representation across ORD from three different laboratories NHEERL, NRMRL, and NERL. Project tasks include: tools and methods for SMM decision analytics (Task Lead: David Meyer ORD/NRMRL); beneficial use of materials (Task Lead: Mark Johnson ORD/NHEERL); innovation and long-term performance (Task Lead: Teri Richardson ORD/NRMRL); and net zero (Task Lead: Michael Nye ORD/NERL).

As part of research focused on the built environment, lifecycle SMM concepts are integrated into the built environment marketplace. Data are lacking in the areas of construction and demolition debris and more data are needed to understand the implications. One key product to address this need was the development of a national methodology to derive a volume of construction and demolition debris. Specific research projects in this area include:

- State of the practice for construction and demolition debris recycling (fiscal year [FY] 16) – this project is complete
- Full life cycle, hybridized and regionalized SMM prioritization tool (FY 17) – this project is in progress
- Perspectives on design of SMM strategies through application (FY 18) – this project will be completed
- Correlation analysis between construction and demolition debris and building Characteristics (FY 18) – this project will be completed
- Generating experimental emissions inventory for construction and demolition materials (FY 19) – this project will be completed
- Improve and enhance data and measurement of construction and demolition and industrial byproduct materials through the development of inventories and flows of wood in the United States economy (FY 17) – this project is in progress

There also are several projects focused on advancing climate adaptation and community resilience efforts that will be completed in the next 3 years.

Dr. Tolaymat shared that as part of the research on sustainable food management, projects are focused on developing an infrastructure to support alternatives to landfill disposal of wasted food. Specific research projects include:

- Designing biochars for remediating metals contaminated soils (FY 17) – this project is in progress
- Mesoporous material derived from poultry and fishery wastes (FY 17) – this project is in progress
- Towards net zero waste: co-digestion at Fort Huachuca (FY 17) – this project is in progress
- Managing food waste in Columbia, South Carolina (FY 17) – this project is in progress
- Methodology to create novel platform chemicals from waste cellulosic or lignin biomass (FY 18) – this project is in progress

Dr. Tolaymat added that research is also being conducted on sustainable electronics management. Electronics waste is an international issue because much of this waste is shipped for disposal in other countries. ORD developed an idea to survey states to identify available data on electronics waste disposal in order to develop a more robust methodology for disposal. Specific research projects include:

- Identifying sustainable materials for laptop enclosures using LCA and Decision Analysis for a Sustainable Environment, Economy, and Society (DASEES) (FY17) – this project is in progress
- Methodology for Tracking, Quantifying and reporting Used Electronics in the US (FY 18) – this project is in progress
- Recovery of Critical Elements and the conversion from Electronic Waste (FY 19) – this project will be completed

Dr. Tolaymat explained that part of his role is to regularly communicate with research partners, and through these discussions issues are raised that prompt changes in future research directions for the next 1 or 2 years. It is important that ORD can address some issues raised by their client offices and by states through various organizations. Communication with research partners is frequent and includes weekly discussions with ORCR, discussion with the regions, and discussions with state regulators. Products are regularly updated to reflect the research needs of our partners. Dr. Tolaymat described the impact of this research and examples of success. Examples include the development of specific methodologies and frameworks such as the Leaching Environmental Assessment Framework (LEAF), which is used for the development of EPA's Coal Combustion Residues (CCR) rules. ASTSWMO expressed a need for post-closure care for RCRA regulated facilities and legacy sites. There are also efforts underway to update the criteria for municipal solid waste landfills under 40 CFR 258. These regulations were passed in the 1980s and 1990s, and more advanced science might be available to support these criteria. The HELP model was developed by the U.S. Army Corps of Engineers and was last updated by ORD in 1994. For many years, the model was not updated. Under current regulation, a landfill cannot have more than 2 feet of standing water above the liner. Only the HELP model is available to assist with this calculation. This model is downloaded approximately 2,500 times per year and is not compatible with Windows. ORD is working on updating the software to improve compatibility.

Dr. Tharakan asked if there were similar efforts to the wood-focused project presented by Ms. DiForte focused on other materials. Mr. Tolaymat replied that the purpose of that work was to look at what various materials are in our infrastructure. In an emergency situation where steel is

needed, it is valuable to know how much steel is currently available in our infrastructure and how the available materials could be utilized. The objective of this work was to conduct more evaluations for other materials such as concrete and steel. However, the work is currently limited to wood due to the available resources and competing research needs.

Dr. Martín asked what percentage of talent EPA uses outside of ORD scientists (i.e., contractors, academics) to respond to the needs of the program offices. He asked how many times OLEM uses ORD rather than contracts the work to outside organizations. Mr. Taylor responded that OLEM frequently uses contractors. For example, the ORCR SMM Program is currently looking at the generation and release rates for several different materials and developing white papers with support from a contractor. This work examines what is known about generation and use rates for various materials streams. In the future, ORCR could work with ORD to address the identified gaps. Contractors are also used for environmental health risk assessments and beneficial use evaluations. When data are needed quickly, contractors are used to find or collect the data.

Dr. Martín asked if there were informal criteria for using contractors such as the immediacy of the request. He asked if Mr. Taylor worked with Dr. Tolaymat on this decision making process. Mr. Taylor replied that this process is changing. Some work is done on the fly, in house; however, if OLEM anticipates specific work is in the pipeline due to the strategic planning process, ORD and OLEM work together.

Dr. Tolaymat added that ORCR can direct a contractor to collect secondary data. ORCR does come back to ORD and the group reviews the documents, as needed. ORD leads other efforts, especially where EPA requires ownership of intellectual property. Examples of this scenario include data collected from a laboratory experiment or from code for a model. Contractors are used when more hands are needed. Secondary data or information needed immediately often goes through contractors, whereas research on intellectual property or laboratory-generated data is handled by ORD. Mr. Taylor added the example of the LEAF methods, during which OLEM worked with ORD to develop the analytical methods. The plan is that once commercial laboratories possess sufficient expertise to run the LEAF methods, OLEM can request that laboratories generate the data. However, OLEM will rely on ORD to develop laboratory methods.

Mr. Steinhoff noted that communities rely on the facts and figures reports to estimate generation rates and other decisions. However, these reports include downscaled data from a national level and are not representative of site-specific data. He asked if the protocols under development (e.g., wood materials flow inventories, C&D estimations) will be useable by individual communities so they can assess themselves and feedback into an LCA. Mr. Taylor responded that the target audience (i.e., final user) is considered during the development process for each model, framework, or methodology. Different tools require different levels of expertise and are directed for use by specific audiences. He said that while he could not speak to the specific example that Mr. Steinhoff gave, he did know that when OLEM develops its own products or in collaboration with ORD, the end user is considered for each tool. Different audiences require different tools and users vary in their levels of expertise. For example, the WARM model has a different user base than a different another model that ORD is developing that also looks at municipal solid waste. Upon ending this discussion, Dr. Flint explained that members will break

to review related posters. She reminded members that members bear in mind the three charge questions as they work their way through the posters.

Poster Session
SHC Principal Investigators and Subcommittee

The subcommittee participated in the research poster session.

Tool Demonstration: MWiz (Materials Management Wizard)
Mike Nye, ORD

Dr. Nye demonstrated MWiz, which is a web-based application that quickly and straight-forwardly connects decision makers, local officials, and other community members to EPA's tools and resources. MWiz assists users by providing easier access to information and resources that would be discovered via an online search. This application represents a cross-collaborative effort between several offices within EPA (e.g., OLEM and ORCR) and several regional offices.

Dr. Nye noted that this project is located in Topic 4, but is relevant to this discussion. Last year, ORD built a green infrastructure wizard. This year ORD built the MWiz tool. The tools are targeted to local and state officials, but there is something for everyone within the interface. The tool is currently in a beta version and will go live on November 15, 2016.

Dr. Nye conducted an example search for the string of terms "EPA materials management, sustainable food management." This search produces over 350,000 results in Google. A search of the same string on EPA's website returns approximately 8,000 results. MWiz can be used to efficiently connect users with key tools and resources; using the tool, searching with the same string produced only 32 results. Users can access refined search results of key EPA materials related to these search parameters. MWiz indexes material that meets three criteria: EPA-owned-and-produced tools (i.e., calculators and datasets) and resources (i.e., PDFs, fact sheets, websites); already located on EPA's public web pages (OLEM, regions, ORD); and relevant to materials management. The user is presented with a library of tools and resources that relate to materials management, are available in the public domain, and are ready for application. Most of these materials come from OLEM's website, but materials from other sources, such as the EPA region websites, are also retrieved.

Dr. Nye explained that there are two pathways presented to the user upon entry to the main MWiz site – Quick links and Explore. These pathways allow users to drill down among search results to find more helpful resources. Site cookies are not used to track users. Users can then generate a PDF of "liked" links to easily share search results and links to resources with their colleagues.

Dr. Nye shared that users can provide developers with feedback on the tool using the "Send Feedback" feature once the tool goes live. Users are encouraged to share their ideas or present resources that were not included in the tool's database. The tool can be accessed online at: https://www.epa.gov/sustainability/mwiz.

Dr. Martín asked if the programs or regions provided feedback that they could not find information and needed a tool to assist with refining online searches. Dr. Nye responded that this tool fits under "making a visible difference" and was put forward as a key need across several groups by the community facilitation team, which includes members of ORD and the Office of Policy. This wizard makes it easier for users to find the specific part of the website. The need

was that there is so much material available and a tool is needed to find resources more efficiently. He shared that Cheryl Coleman of ORCR raised this as a need. MWiz was the first proposed wizard.

Ms. McCullough added that the cross-agency and sustainability group has shown that communities have a difficult time locating the materials they need. Communities expressed a need for tools to narrow down search results and resources.

Mr. Steinhoff asked if there is anything planned to track queries to influence the development of pre-defined lists of relevant materials related to that query (i.e., quick links). Dr. Nye agreed that this is an interesting approach. He responded that the MWiz development team is building an administrative module for tracking that will allow OLEM to update the tool rather than go through a contractor or web moderator to add additional resources as they become available.

Partner Panel Discussion
Liz Resek, ORCR; Tim Taylor, ORCR; Nicole DiForte, Region 2; Ann Carroll, OBLR

Dr. Carroll described the Brownfields Program, which was started to address an unintended consequence of CERCLA. People were afraid to invest in potentially contaminated sites. A brownfield is not necessarily a contaminated site, which presents challenges when working with ORD. The program is not a regulatory entity and is community driven. A community applies for grant funds, and the program helps applicants identify sources of contamination and develop approaches to turn the site into a safe site-reuse location if that contamination is identified. If contamination has already been identified on a site, then the entity responsible for that contamination is not eligible for a brownfield grant. Brownfields are not Superfund sites, sites undergoing active enforcement, or federal facilities. Absent these exceptions, nearly anything can be a brownfield and examples include clandestine drug laboratories, dry cleaners, former industrial sites, non-regulated petroleum tanks, gas stations, scrapyards, and properties near railroads. Dr. Carroll shared that the program continues to strengthen its relationship with ORD, but continues to identify areas in which it can best work with SHC.

Dr. Geller stated that ORD has encouraged the enhancement of their social science capacity. He wondered if brownfields is an area that might bear some fruit because the program includes consideration of community perception. He asked if the brownfields community has thought in terms of social science. Dr. Carroll replied that the Brownfields Program has not been well harnessed with this information, but has thought about social science. The Brownfields Program has some authority to lead research training and other technical assistance projects. The program utilizes contractors to complete some of this work. The Brownfields Program is working with the University of Louisville to develop a community benefits calculator that can be used by individual communities to "sell" to their city council the benefits of site cleanup and brownfields projects. This calculator can assist with risk perception.

Ms. DiForte added that similar issues are observed at Superfund sites. However, the associated stigma and related social issues are amplified at these sites.

Dr. Carroll added that the Brownfields Program deals with a different part of the civic structure because some grants go to the community and economic development instead of traditional groups. The dialogue and research areas of interest differ among these different groups.

Mr. Taylor agreed with these statements and added that the RCRA headquarters group interacts with members of communities in a wide range of scopes. Examples include public meetings in a community, state regulators, and voluntary programs that require interactions with representatives of environmental or an entire industry. Communication and messages are tailored to each audience. The needs of the community are often considered when developing RCRA-related projects.

Dr. Flint observed that the definition of community is multi-faceted. Mr. Taylor agreed with this statement. Different communication approaches are used for different communities (e.g., community of toxicologists *vs.* community of highway design engineers).

Dr. Martín asked how OLEM communicates with these various communities. Mr. Taylor replied that this process varies with each project. In many respects, OLEM's process is the same as the process used by ORD. projects are developed because a specific group, such as ASTSWMO, has communicated a need. These needs feed up from the community. Individual EPA staff are also often approached by individuals who express specific needs. If there is a pattern in what EPA staff hear, they present these needs to their respective office. OLEM recognizes that is important to consider the stakeholders and need to communicate with those people about what they need.

Dr. Meyer suggested looking at the issues raised by grant applicants in their brownfields applications. There may be common needs expressed in these applications that could be addressed by ORD. SHC's activities may also inform the grant application process.

Dr. Carroll shared that the United States Government Accountability Office (GAO) estimated a few years ago that there are about 450,000 brownfields, and OLEM has stopped estimating this number. In the last year, the Brownfields Program has funded 218 grants distributed to 131 communities. The total value of these grants is $55 million. Some of these grant recipients are repeated from previous years and some are brand new recipients. The challenge with the grant applications is that only 25 to 20 percent of applicants receive an award. There are structured application criteria in the statute. The Brownfields Program is somewhat tied to this statute with the criteria, but the boundaries can be slightly changed in the grant guidelines. Recipients of planning and cleanup grants are required to consider climate and factor in resilience as part of their project planning. The program recipients are long-term supporters and practitioners of smart growth and grantees are encouraged to follow principles of livability and sustainable materials management. These research tools must be tied into projects with different time scales.

Dr. Geller asked if there is something that ORD could help the Office of Brownfields and Land Revitalization (OBLR) frame this issue. He noted that a screening-level assessment could be a valuable tool for delisting sites. There are issues of perceived contamination and whether there are things that could reduce the number of sites perceived as contaminated sites. Dale Werkema will present his research on the use of geophysical methods, which could be applied to help rapidly characterize sites for delisting or at least partitioning them. Dr. Carroll responded that OBLR is always interested to learn from ORD's discoveries. OBLR only responds to what communities apply for, which can be tricky. Communities might also seek funds and request technical assistance from OBLR rather than apply for a grant. OBLR also supports state and tribal programs with their own brownfields programs. States and tribes oversee the brownfields activities in their respective jurisdictions.

Dr. Rubin asked for an example of a sustainable community project that has resulted in improvements in the community. Dr. Carroll responded that in 2008 OBLR began helping communities that want to turn vacant lots into community gardens. There is limited information on the impacts of community gardens, but they are in high demand. OBLR partnered with states, tribes, and community organizations to develop rudimentary screening and approaches for site-selection. The response from the community was quite strong and OBLR has contributed to projects along the food lifecycle, such as the use anaerobic digesters for food waste. This project is not specifically SHC, but it represents a holistic way of thinking about health challenges faced by communities. Exposure to other issues beyond chemical contaminants (e.g., violence) could drive health risks and outcomes.

Dr. Flint asked if the subcommittee had any additional questions on RCRA areas.

Dr. Nance asked that the word community be defined more specifically in the context of this discussion. "Community" can have many different meanings.

Dr. Raffaele asked Mr. Taylor to provide an insight on how the needs of his program are being supported relative to ORD's resources. Based on the posters, there are certain aspects of research where ORD is heavily invested while others do not receive as significant of support from ORD. She observed a strong working relationship with Ms. Resek's group on the development of models for LCA. There is a shift between looking at legacy sites and thinking about the future and how materials management can be integrated in the future and at legacy sites. Transforming hazardous waste is also an important consideration. She noted that there has not been much discussion about ORD's support for OLEM's work that supports corrective action side of RCRA. There is a long list of OLEM's projects that supports work on corrective action and these projects are important to the SHC Program.

Mr. Taylor added that an aspect of the support that is reflected in the posters, but was not included in his presentation is the translation of research into tools. There are other LCA tool sets and their function is that users on a local community level can use these tools for decision-making in their immediate area. These tools could also be used by a state regulator who, for example, needs to design a new regulation or by users within industry that need assistance communicating with a state or local community to ensure everyone is speaking the same language.

Dr. Raffaele shared that the beneficial use (BU) work is becoming an important part of the program. There were a number of elements within the posters dedicated to identifying BUs. One example of this work is designing test methods to better understand the likelihood that hazardous constituents are bound up within a matrix or released in the environment. This work speaks to the legacy and sustainability aspects of the program.

Mr. Taylor noted that the needs of users could be different for RCRA hazardous waste and RCRA non-hazardous waste applications. Beneficial use is evaluated to support decision makers in states and local communities. EPA makes decisions on hazardous waste, so the application of beneficial use is different. OLEM provides documents to other people performing BU evaluations (e.g., a methodology document for conducting the evaluation) on industrial materials.

BOSC Discussion

Subcommittee

Dr. Tharakan presented a high level observation about how EPA is conceptualizing SMM. He noted that recovery does not seem to be explicit in EPA's thinking, which appears to only be focused on reduce, reuse, recycle, and dispose. He recommended including recovery explicitly even though "recycle" encompasses recovery. Making recovery explicit expands the environmental thinking so that eventually the amount of disposal goes to zero, and net-zero recovery can be reached. While he observed cradle-to-grave thinking whereas, the 21st century thinking has been expanded to consider cradle-to-cradle management. This expanded thinking needs to be incorporated into how analyses on SMM are presented.

Dr. Cervero shared that he was struck by the regulatory or public policy piece that could come out of this research. The SHC program may be limiting itself to embodying cost or price in the supply chain and production of components and materials. He wondered to what degree these influence of price on the economic recovery of waste is understood. He added that there are several good models available to predict the impacts for the volumes of waste or materials and how they can be reused. Some of these models rely on means and averages over a spatial unit with less understanding of the variation around these values and units. While these models can be used effectively to inform policy and regulation, it is less clear how data quality can be measured to inform these models.

Dr. Flint pointed out that she recalled hearing about the inability to get data. There are barriers to information that would inform cross-assays on various scales. She also recalled hearing about interactions between ORD researchers and outside entities including industry, states, municipal partners, and international partners, which appear to be very strong. However, there remain barriers in terms of data collection via surveys. These surveys would systematically allow the incorporation of context-sensitive needs and issues. This is a barrier that must be overcome. Survey work will come if ORD is moving in the direction of social science.

Dr. Meyer provided a comment directed at the discussion led by Dr. Carroll on the Brownfields Program. The Brownfields Program receives a massive number of applications from individual municipalities or counties that all express a need for money to address a specific problem. In many instances, these problems could be a reasonable research item for ORD. He wondered if the applicants are showing ignorance and what understanding do these applicants need to show when writing their application. These applications could provide a source as data for identifying research needs among local entities.

Dr. Meyer shared that there was a poster on tracking electronic waste and where it is flowing. Adjacent to this poster were two posters about net zero. He was struck that net-zero communities are ideal and partners in this entire process. Net-zero communities might be the ideal place to field test other ideas related to materials management, such as asking communities what they do with your electronic waste. There is no locally based form of collection for electronic waste. He suggested conducting a field test to address these issues using the net-zero communities that already work with ORD.

Dr. Nance stated that she was pleased by the quality of the posters and the work described. She noted the significant amount of work done in the area of LCA. She did not know that LCA had

been embraced so fully by EPA. She was impressed that LCA is used as a measure of sustainability.

Mr. Naud noted that his community's economic development staff are not involved in discussions on managing waste streams. He wondered if ORD's tools could be applied to help sell waste and materials management to economic development groups. These tools could be helpful on a local level if they provide an assessment of cost on a macro level (e.g., jobs) and an illustration of how materials management can contribute to economic development.

Dr. Irwin provided a follow-up comment on the idea of pricing. The goal is to develop tools for decision making. The typical policy perspective would be to consider the benefits and costs of any decision. She supported moving in the direction of incorporating a tradeoff analysis. While in general that analysis seems to be lacking in the presented research, there were positive indicators that these kinds of considerations are being accounted for in LCA work. For example, the cost of inputs and the tradeoffs of reducing environmental impacts were considered along with the costs along the supply chain. She pointed out that there can be positive and negative impacts to incorporating remediation services. There is a general idea of incorporating tradeoff assessment into the tools so that these tools better inform decision making. Another big step is to incorporate behavior into the tools to better understand how people will respond to the decision. Incorporating behavioral research at a personal and community level is a critical future need. Dr. Flint added that the behavioral piece is now mandated at a federal level. Complete cost accounting was considered in the poster "Techniques for Separating Organic Solvents to Facilitate Reuse and Remanufacturing" presented by Leland Vane.

Dr. Geller introduced Ms. Susan Thorneloe to provide clarification on cross-communication within the program. Ms. Thorneloe shared that the next generation of the municipal solid waste decision support tool (MSW-DST) is being developed. The new version of this tool will incorporate consideration of full-cost accounting and environmental tradeoffs associated with managing MSW. This tool is housed within the Air, Climate and Energy (ACE) research program.

Dr. Dannenberg asked if disposal or recycling fees are considered within the MSW-DST. Ms. Thorneloe replied that the whole cost of the lifecycle is considered within the tool. She is not sure if there is a database that accounts for these considerations.

Dr. Rubin stated that he was also impressed by the posters. There was a poster on the application of risk-informed materials management to determine safe levels of contaminated materials. This process involves looking ahead of time at what materials are used so that at the end-point users are aware to the net zero products. He noted that scientists are being challenged to look at every aspect of materials management. He also pointed out that it is important to consider both environmental science and social science. If only environmental science and environmental impacts are considered and not the impact of the environment on people, then the community (i.e., a group of people living in the same area) aspect is missed. For the purpose of this discussion, a community needs to refer to close geographic proximity. Dr. Rubin also noted that communication between the scientific community and the community of people being served is missing. The subcommittee touched on this yesterday and discussed that there are elements within EPA to translate science into public language. However, this needs to occur at a greater

level. He recommended increasing the emphasis on translation and communication between the scientific community and the community being served.

Dr. Nance shared that in a contentious rule was on the ballot in Houston about having multiple recycling bins or one recycling bin. Voters were against having a single recycling bin because they feared the material would not be recycled at all. This is an example of the importance of having behavioral information and understanding how people think about issues and situations. It is not enough to have the tools or the science if personal behavior and drivers are not understood.

Mr. Kelly stated that the posters illustrated great science to evaluate waste streams. However, this information needs to be placed in the hands of people who can use it best. It is important to involve the community because they are looking for tools to deal with these problems. Communities want to deal with brownfields, and giving them tools to identify and circumvent issues related to these sites is important. With respect to changing land uses, there are many issues related to the sustainable use of specific properties. Communities are looking for tools to help with decision making. This information needs to be placed in the hands of the community, defined in the broadest sense.

Dr. Martín stated that he is still grappling with the quality of the data because it appears anecdotal. The majority of the research posters are on Project 3.63. More information is needed on the frequency of SHC's conversations with ORD, the level of SHC's participation with respect to the StRAP and project level conversations, and the sense of the quality of ORD's response to these conversations.

Dr. Cervero noted that it is important to consider a global framework for thinking about materials management and demands. The United Nations reports that there will be demand for the reuse of materials generated in the United States to construct new sites such as in areas of Africa. Modeling materials management within the boundaries of the United States is constrained and should be considered on a global scale. Data should also be shared with international environmental agencies.

Mr. Naud provided a comment on the survey component of social science. There is interest in how social science data are collected in cities. There are opportunities for partnerships. There are a dozen foundations that give cities millions of dollars per year to work in the area of urban sustainability. A partnership might be formed if it could be demonstrated that data collection drives federal policy. There is a network of cities that participate in these programs. The same instrument could be used to compare within network. Dr. Flint added that extension through agriculture experiment stations and land grant universities could provide another opportunity to expand social science outreach.

Dr. Tharakan pointed out that concentrated animal feeding operations (CAFOs) were not mentioned at all. He asked if CAFOs are outside of EPA's purview. There are many synergies that can be viewed from combining animal waste and other waste streams. Mr. Taylor responded that CAFOs are outside of OLEM's view; CAFOs fall under Offices of Water and Air and Radiation (OAR). However, concepts associated with CAFOs translate to SHC.

Mr. Taylor stated that ORD has been doing work in structured decision making, which examines how people make decisions. Structured decision making is being incorporated into ORD's tools.

Research priorities are not the same across all municipalities or localities. It is important to build the identification of local priorities into the decision making process.

Dr. Geller shared that the DASEES tool includes application of structured decision making into the site remediation process. Ms. Lynch is leading this work.

Dr. Flint noted that some research projects have looked at variations across states and incorporating those objectives into the process.

Tool Demonstration: RIMM (Risk-Informed Materials Management)
Justin Babendreier, NERL

Dr. Babendreier introduced himself as an Environmental Engineer who has been with the Agency for 15 years. He works in the area of integrative environmental modeling with an emphasis on building tool systems that have standards-based approaches to address uncertainty and sensitivity. These evaluation models help predict what will happen when waste is managed in a particular manner.

Dr. Babendreier described the RIMM tool as a multi-media modeling tool used for fate and transport. The model incorporates mass-balance and provides a cumulative integrated exposure and risk assessment solution for SMM. The tool is applied to environmental assessments to uniquely capture exposure across media-pathway combinations and risks associated with materials management. The tool provides full source-to-outcome analysis. It interpolates across the following paradigm based on certain decision variables that a community chooses—Source-Release → Fate and Transport → Exposure → Dose → Outcome.

Dr. Babendreier stated that the RIMM tool system involves a three-step process. The first step is to acquire site data for scale of interest (e.g., state, regional, national level). The second step is to model site impacts and address uncertainty. The third step is to decide protective levels of contaminants. One of the unique aspects of the tool is that it can incorporate uncertainty with any kind of data and every data point can be treated as a distribution. Multiple dimensions of uncertainty analysis can be conducted. The tool has the unique capability to do spatial hierarchical sampling. The tool finds the best available data to run the model. If site data are not available, data from regional or national databases are used.

RIMM Tool System includes the HE^{2}RMES (Human and Ecological Exposure and Risk in Multimedia Environmental Systems) Project Builder Tool. This tool is an open GIS system that they have built. It allows one to go anywhere in the country, create a site, and gather the site data (e.g., for a farm, landfill, roadway). The HE^{2}RMES Project Builder Tool resides within the generic, open-source GIS tool. Users can select data from a series of data layers (e.g. watershed catchments, terrain). The tool can incorporate different two and three dimensional aspects. As a site is created, an inventory is built up for spatially-explicit data for hydrology, soils, and land uses among other variables. The output can be referenced with baseline map layers such as Google Maps and Bing hybrid map.

Dr. Babendreier noted that during the first step of using the tool, users create a site and the source term of interest within that site. This step can produce more than just a site to study in HE^{2}RMES. Once users select a model to run, the tool generates a database that is consumed by the next step of the tool.

The second step of using the tool is to model the site impacts and address uncertainty. All of the different types of source terms can be tied into a connected, integrated environmental perspective of fate and transport. The result is that various exposure and ecological risk profiles are calculated. The tool addresses the basic question of "What is the safe level for a specific contaminant material in a specific scenario."

Another unique part of this tools system is the FRAMES (Framework for Risk Analysis in Multimedia Environmental Systems) infrastructure. FRAMES can bind across different computer programing languages; hence the input and output of different modules can be tracked even if they are written in different programming languages. Quality assurance perspectives can be added to prevent errors. The system is checked in many different ways across the boundaries (e.g., the units can be checked).

The tool automatically runs all of the models and tracks the input and output (i.e., does integrated "plug-and-play modeling" between different types of science tools). If a user wants to apply another model they think is better, it can be added to the system. The tool is open platform and object-oriented.

Dr. Babendreier noted that this tool system has triplets, iterators, samplers, and summarizers that can be configured in many ways. This allows for many different sites to be run along with Monte Carlo simulations. He illustrated how more iterators, samplers, and summarizers can be added to create a more complex experimental design. These components are flexible and can be combined nearly any way the user wants.

As the end, the tool runs the human risk, ecological exposure, and ecological risk models. The RIMM safe-level processors put all of the data in perspective for the decision maker. The outcome provides a basic range for exposure and risk. It allows the user to generate curves to determine a safe level. Dr. Babendreier showed an example of a RIMM safe-level uncertainty analysis curve. It showed the relationship between the percentage of sites protected and a given material stream concentration. He also described an example of how the tool could be used in the BU assessment of flue gas desulfurization (FGD) gypsum in agriculture. The tool could assist OLEM in understanding the true exposures that would take place across the country if, for example, farms are allowed to apply FGD gypsum twice a year.

The tool tracks the different exposure profiles and helps the user to identify the most restrictive scenario out of all the scenarios studied. For example, the user can consider whether the ecological risk profile or human risk profile is more protective. The user can analyze the effects of tradeoffs. For any given study, a heat map will be created summarizing the results. The top half shows the results of the uncertainty analysis and the safe level ranges. The bottom half provides a relative sensitivity index to show what pathways drive the concern (e.g., groundwater ingestion, food ingestion, fish ingestion). The heat map provides the relative balancing of the risk across the different exposure pathways and receptor types (both human and ecological).

Dr. Flint asked about layers and the geospatial specificity. The attributes of those data are dynamic. The timeline for the data is critical. For example, there might be land ownership changes or zoning changes, and therefore objectives for land use may be changing. She asked if Dr. Babendreier could discuss the dynamism in the landscape and how it is represented by the data, including the timeliness of updates. Dr. Babendreier responded that the tool uses available

baseline data to do the spatially explicit modeling. It does not allow free choices between sets of data, such as census block data. He explained that you can modify the landscape datasets that are pushed into the modeling system. This allows the user to consider future conditions as well as the baseline conditions that are pulled from the internet. The user can do a comparative analysis by proposing land use changes in the system. This allows the user to predict the future before it happens.

Dr. Martín asked if Dr. Babendreier could discuss OLEM's role in the development of the tool and if someone from OLEM could speak to their use of the tool. Dr. Babendreier responded that he typically meets weekly with Mr. Taylor from OLEM (formerly known as OSWER), and they have a two-hour discussion of how to use the tool. Dr. Babendreier plans to work with Mr. Taylor and other OLEM staff over the next three years doing application work.

Mr. Taylor explained that components of the RIMM tool were originally developed for OLEM in the 1990s. HE^{2}RMES is a collection of models that were originally developed to support OLEM's Hazardous Waste Identification Rule (HWIR). The models went through an exhaustive peer review. The peer review concluded that these tools, when used together, do a valid job for their designed purpose. They found that each individual model was valuable as long as OLEM could get at them. Unfortunately, the system was difficult to use and modify. Originally, the models were hard-wired with specific demographics and cohorts (e.g., age). The model was difficult to modify when new assessments used different cohorts. ORD has been working to modify the original models to accept changes and also to put the models into the RIMM "plug-and-play" environment. This will allow new models to be easily pulled into the tool when necessary. Mr. Taylor stated that his group worked closely with ORD on the development of the original models. Also, he worked closely with Dr. Babendreier on the proposal for the current tool. They are working together to determine how to improve the system. Dr. Babendreier added that the legacy of the system was retained in the new tool. ORD captured everything from the beginning. There is nothing about the tool that is not transparent.

Mr. Taylor added a comment to the earlier question about how often OLEM uses contractors. He explained that they previously relied on contractors to run the models due to their complexity. However, this approach became expensive and time consuming. One goal of this project is for ORD to deliver a tool set that can be run on their own desktops instead of relying on contractors.

Dr. Tharakan asked about modeling human exposure and whether environmental justice issues can be worked into the model. He asked if the tool can discriminate amongst different populations. Dr. Babendreier responded that the tool currently models sites, and it gets the census block data for those sites with inherent characteristics. He explained that one could design a site sample study that could easily apply environmental justice to the tool and it would be a way to explore the utility of the tool. Dr. Flint commented that looking at the social determinants of risk in the model would be critical.

Tool Demonstration: WARM-LCA (Waste Reduction Model – Life Cycle Analysis)
Wesley Ingwersen, NRMRL

Dr. Ingwersen stated that he is part of the NRMRL LCA Center for Excellence established mainly in Cincinnati. He explained that his presentation would cover the work being done with ORCR on their WARM model. ORD's role is to help migrate WARM to a new platform called

openLCA. WARM was developed by OLEM approximately 15 years ago. WARM is a greenhouse gas and energy calculator. It is a simple foot-printing tool for evaluating different municipal solid waste management options like landfilling, incineration, composting, recycling, and source reduction of specific waste types. It provides specific greenhouse gas emissions estimates for life cycle management for different waste types, such as food waste, paper, and plastic. It exists now as a spreadsheet model (accessible at epa.gov/warm), and is widely used by thousands of users in states and communities in the United States and in other countries. The data for WARM is continually being updated to add new materials and different waste management options. The option to model aerobic digestion of organic waste was recently added.

Dr. Ingwersen explained that WARM has some limitations owing to how it was developed in its native platform. For example, right now, one cannot take the data from WARM and put it directly into a standard LCA model. It would have to be run independently because the user does not know everything that is happening with WARM, such as assumptions being made. Documentation does exist for WARM, but the underlying data are not transparent. WARM is created in a spreadsheet platform. With complex models, the spreadsheet platform makes it difficult to follow and manage and it becomes easier for errors to occur. WARM has limited ability to configure scenarios or to modify embedded assumptions (e.g., carbon storage in the landfill).

Dr. Ingwersen explained that openLCA has been ORD's primary platform for LCA studies since 2013. Previous to that, ORD went through an extensive review process to evaluate different LCA software tools frequently being used in studies. Those tools were compared to a newly developed tool at the time called openLCA, a freely-available open source platform. ORD decided there were many potential benefits to using openLCA. For one, the models developed within openLCA could be shared and distributed freely. The other LCA software tools on the market all had expensive licensing agreements. Also, ORD wanted to be able to go in and do quality assurance and understand everything the software was doing. The open-source format allows them to understand the quality of the data and enhance the software package. In 2013, ORD began collaborating with the owners of the openLCA platform, GreenDelta, to enhance the software. Since that time, openLCA quickly became one of the world's most widely used LCA software tools.

Dr. Ingwersen stated that WARM was moved over from its native spreadsheet platform into the openLCA platform. The tool is now more transparent and data can be made available for users familiar with LCA. It is now more modular and customizable. Another benefit relates to the sustainability of the WARM model and its management in the future. A goal is for WARM to integrate LCA data from other LCA activities inside and outside of the Agency. Thus, there is a need for a platform that would allow this type of data to be imported and meshed with the current model. An open platform would also enable supplementation with datasets that are able to characterize other types of impacts besides just greenhouse gas and energy. Another goal is for data from WARM to be integrated into some of the other LCA tools being developed in the Agency, such as the SMM Tool. WARM in openLCA will have more analytical power. OpenLCA is continuously being enhanced to increase its ability to present and visualize complex life cycle results and to be able to drill down into the sources of impact with more detailed exposition. Having the new platform allows them to do that.

Dr. Ingwersen showed the participants the WARM demo version. The target audience for openLCA WARM is the exact same user base. The goal is for openLCA WARM to become an alternative that may eventually replace the old WARM spreadsheet platform. ORD worked with ORCR to have the same user interface, flow, and terminology as the existing WARM platform. It looks similar to the existing platform and has similar steps.

Dr. Ingwersen explained that WARM is a material specific calculator. Users can choose the materials they want to study, which are primarily municipal solid waste materials. The user first constructs a baseline scenario for material management and then constructs an alternative scenario for comparison. As an example, Dr. Ingwersen chose food waste as a material to study. The baseline scenario was sending 100 tons of food waste to the landfill. The alternative scenario was composting 100 tons of food waste. He explained that at this point in the process, the user can choose for the tool to use state or national average data. The user can also modify the default transport distances to the landfill or compost facility. Landfill characteristics and other variables can be modified as well. However, the majority of users select the default options because they do not know all of the specific information for their community. The final report can provide the total greenhouse gas estimate in carbon dioxide/carbon equivalents, or the user can evaluate life cycle energy.

Dr. Ingwersen ran the model and showed the summary report screen that listed the total metric tons of carbon equivalents for both the baseline and alternative scenarios. To understand more about the results, the model has various analysis options that are particularly helpful when analyzing many different alternative scenarios. The new openLCA version of WARM has a better capacity to visualize the results and break down the sources of the results (e.g., determining how much of the total emissions came from methane versus carbon dioxide). The contributions screen can show the user exactly what activities are resulting in greenhouse gas emissions or credits. The summary report, graphs, and analysis charts can be exported into an HTML file that can be shared with colleagues.

Dr. Ingwersen concluded that openLCA WARM allows the LCA expert user to understand where exactly the numbers are coming from in WARM. It also allows for modifications. An LCA model is basically and an input-output model. The input side has resources or purchased products, and the output side has output products and emissions. Using his previous example of landfilling versus composting food waste, Dr. Ingwersen showed a screenshot of the type of information that an LCA expert user can access in the new platform. He explained that the user can see the values for each of the variables being used by the model and make modifications if needed. The user can also see the calculation that the model used to determine the amount of carbon storage that was created by composting.

Mr. Naud asked if the model can contrast typical landfills with the new biocell landfills. Dr. Ingwersen replied that biocell landfills are included as an option. The user can select different landfill operations and landfill gas recovery systems. Bioreactor landfill and aggressive gas collection system are also both options.

Dr. Cervero asked if the user can see the parameterized models. Dr. Ingwersen replied that users can see the parameterized models because WARM has been moved to the new open platform. Dr. Cervero responded there some modeling is based on understanding spatial patterns and correlations where the user can show error turns reflecting omitted variables. There are patterns

that can include predictions. He wondered if there is the capacity to improve the modeling by passing in the spatial quality of the data. Dr. Ingwersen stated that this was possible and clarified that WARM does not use geospatial modeling.

Dr. Cervero noted that the data is representative and asked if it can be showed in a spatial unit. He wondered if the model can show where the waste reduction is within a certain GIS layer. Dr. Ingwersen responded that users could output data and add it to some kind of a GIS layer, but the model itself is not designed to do that.

Program and Regional Office Overview of Research Needs
Dan Powell, OLEM

Mr. Powell stated that he is part of the Superfund Office focused on site characterization and cleanup technology. This group works across the waste program and corrective action programs, not just in Superfund. Although Mr. Powell's work is focused on technology, he stated that his presentation will incorporate information on Superfund policy. Significant progress has been made since he began working on Superfund remediation in 1990. The program works closely with ORD to leverage their research and expertise and will continue to leverage that relationship and to make use of the available research.

Mr. Powell explained that Superfund sites present a diverse set of opportunities and needs. There are numerous permutations of cleanup and public health issues, many decisions to be made, and a diverse array of supporting needs. The types of decisions made at waste sites vary (e.g., determining if the site is compliant or clean, where the contamination is, how much contamination is there). Research support continues to be crucial and requires innovative ideas for new and existing issues. Mr. Powell emphasized that the research and expertise within ORD are both important. Specifically, the expertise of the Superfund and Technology Liaisons and researchers in the laboratories is critical. This expertise is what helps OLEM apply ORD's research at Superfund sites. Mr. Powell shared that when he speaks with personnel associated with the waste programs, they want to know how the research can be applied at their specific sites. The application of research is essential.

Mr. Powell stated that the Superfund Program works with ORD and with the regional remedial project managers, their contractors and consultants, state regulators, and stakeholders within the community to determine what technologies are used at sites. It is important to leverage and collaborate with other research programs, such as those of the Departments of Defense and Energy and the National Institute of Environmental Health Sciences (NIEHS). These research programs are all looking for research that is relevant and impactful.

Mr. Powell provided history on the Superfund Program. It is important to understand where the program began and where the program has been in order to understand where the program is going. In 1990, codification of the Superfund Amendments and Reauthorization Act (SARA) into the NCP brought about a preference for treatment rather than "dig and haul" or capping. Innovative treatment technologies (i.e., technologies whose routine use is inhibited by lack of data on performance and cost) became important over time as there was a push to determine how to treat waste in place rather than removing it. In the beginning, a limited menu of treatment options was available. For soil, the options were incineration and solidification. For groundwater,

the primary method for cleanup was pumping and treating at the surface. Laboratory-based analyses were the only available method for site characterization.

Mr. Powell stated that between the years of 1982 and 1985, about 90 percent of groundwater remedies were pump and treat options. During that time, about 75 percent of soil remedies were containment and only 25 percent provided treatment options. During the 1990s, the technology program grew rapidly. The Exxon Valdez oil spill brought attention to the use of bioremediation, which was used to clean oil from beach sands. Mr. Powell explained that the public began to question if EPA was doing enough to apply research in the field. EPA began looking at other options for treating soil. EPA also became interested in field analytics and alternative sampling approaches to apply laboratory methods in the field.

Mr. Powell noted that, also during the 1990s, many research programs with an interest in Superfund sites were funded across the federal government. These included EPA's Superfund Innovative Technology Evaluation (SITE) Program and Environmental Technology Verification (ETV) Program, as well programs at the Department of Energy (EM-50) and Department of Defense, state programs, and non-profit/private sector programs. Focus shifted to applying developing technologies in the field.

During the years 2000 to 2010, research and development budgets were reduced. The focus moved from using one technology to solve a problem. Focus shifted to treatment trains and the application of multiple technologies to address a problem. There was a movement towards the use of platforms rather than individual technologies. There was a greater focus on groundwater and a broader use of alternative technologies.

Recently, there has been significant growth in the areas of brownfields and land revitalization. This involves turning contaminated sites into sites of productive re-use for the community. High-resolution site characterization technologies have also been developed. Focus shifted on the application of available tools to measure and display data in a way that enables decision-making. There has also been growth in *in-situ* source treatment technologies (e.g., thermal approaches, oxidation). These technologies are used to decrease the time needed for cleanup processes.

Mr. Powell described a pie graph illustrating the Superfund remedies for sources during the years 2009 to 2011. Almost half of these remedies involve treatment. The remedies for groundwater have changed since the 1980s. Currently, 35 to 45 percent of the remedies involve treating groundwater in place rather than pump and treat. A rich mix of remedies are available along with a mature consulting and engineering sector to implement them.

Mr. Powell noted that there is increased interest in big sites. There are about 1,390 sites on the Superfund National Priorities List right now. OLEM has deleted 392 of those, and almost 1,200 are at the point that construction is completed at the site. That leaves behind large problems that need to be dealt with, such as large solvent plumes, mining sites, and sediment sites. The challenge is to break down the complexity of these sites.

Mr. Powell explained that OLEM also has an interest in high resolution site characterization. This involves technologies that allow them to gather many data points to help reduce uncertainty. These technologies include conceptual site models, data management tools, and visualization tools.

Mr. Powell described green and sustainable remediation, another high interest area. This area includes approaches, components, and energy use. Research in these areas helps determine, for example, how to reduce the environmental footprint of large construction sites and how to make cleanup approaches more resilient to climate change. Another current area is contaminated sediments. OLEM has worked closely with ORD in this area. For example, the Interstitial Water Remediation Goals (May 2016) is a document created by ORD that helps OLEM understand what is important for decision making. Emerging contaminants is another area of high interest and OLEM is evaluating how to improve characterization and remediation at sites with Teflon-like and fire-retardant materials containing per- and polyfluoroalkyl substances (PFAS). For sites with lead and other metals, OLEM is developing tools to assess the bioavailability of lead and conducting research into the use of soil amendments to reduce the bioavailability of lead as an alternative to "dig and haul." For sites with trichloroethylene, OLEM is focused on gaining a better understanding of the drivers behind seasonal variability in indoor air contamination and residential-scale indoor air treatment technologies. Mr. Powell stated that OLEM is constantly addressing new contaminant issues or revisiting cleanup levels chosen for contaminants in the past.

Successful Partnerships
Kira Lynch, Region 10/ORD; Amy Pelka, Great Lakes National Program Office

Ms. Lynch described Superfund community engagement to help the subcommittee understand how ORD technical support is integrated into Region 10's decision process. She described the decision process used for a Superfund site. The first step is identifying the site. Then, EPA performs remedial investigation and risk assessments followed by a feasibility study. Next, EPA creates a proposed cleanup plan followed by formal public comment period. The next step in the process is a final decision (i.e., EPA's Record of Decision) that becomes implemented in a remedial design and remedial action. Lastly, there is operation and maintenance. Ms. Lynch emphasized that community input and engagement is integrated throughout the entire process. ORD technical support applies to all of the steps in the process.

Ms. Lynch described a recent example of how ORD technical support was involved in Superfund community engagement. The Upper Columbia mining site in Washington State impacts a Native American reservation. The region is currently in the process of determining how to remediate lead in homes. Private property lead remediation typically involves digging up the soil and bringing in a new topsoil cover. However, the tribal properties in this community are not interested in removing the soil and all of the vegetation. The remedial project manager came to Ms. Lynch for assistance, and she reached out to John McKernan and ORD's Engineering Technical Support Center. Together, they assembled a team of ORD scientists who are identifying alternative solutions. One proposed alternative remediation solution is to add amendments, such as biochar, to the soil. Region 10 has also sought assistance from an expert from the University of Washington to provide technical assistance. This is an example of a community reaching out to EPA for options that integrate newer science. The region responds by reaching out to Ms. Lynch, who in turn reaches out to ORD to identify alternative solutions.

Ms. Lynch explained that ORD helps address regional needs in cleaning up communities. Their support falls into four different categories: research, technical support, applied science/field application, and research translation and training.

Ms. Lynch discussed how ORD provides the regions with general technical assistance. There are many sites with per- and polyfluoroalkyl substances (PFAS) contamination. At these sites, removing communities from the public water supply has been proposed. There is little technical expertise with these chemicals among EPA regional personnel. EPA Regional Program Managers request assistance with analyzing samples for PFAS. Ms. Lynch then reaches out to ORD, discusses the issues with the experts, and brings them in to assist with regional projects to ensure the current science is applied in the decision-making process.

Ms. Lynch explained that Region 10 also has projects with ongoing applied science, for example, in the area of soil amendments. ORD has ongoing research projects on soil amendments that can be integrated with problems faced in the field.

Ms. Lynch stated that Region 10 also has research needs related to research translation and training. ORD has developed tools, workshops, training, and direct application on projects that the regions value.

Ms. Lynch noted that there is a wide range of needs for contaminated sites projects, and the regions do not have expertise in all of the different areas. The expertise that ORD provides is critical to the regions to ensure they are using the best science. ORD's technical assistance to OLEM and the regions includes the following areas: engineering, ground water, monitoring and site characterization, Superfund/human health risk assessment, and ecological risk assessment. ORD also provides specialized technical expertise for waste-related regional projects. They evaluate remedial technologies, develop and review sampling plans, test innovative technologies, and develop technical papers. Technical Support Centers (TSCs) provide a valuable link between research and contaminated site problems. Ms. Lynch noted that several posters in the upcoming session describe the various types of support that ORD provides to the regions in the area of contaminated sites.

Ms. Lynch described a map of the ORD TSC locations. The Engineering, Superfund Human Health Risk Assessment, and Ecological Risk Assessment Technical Support Centers are located in Cincinnati, Ohio. The Site Characterization and Monitoring Technical Support Center is located in Atlanta, Georgia; Philadelphia, Pennsylvania; and Las Vegas, Nevada. The Ground Water and Ecosystems Restoration TSC is located in Ada, Oklahoma.

Ms. Lynch described the various ways the regions can set up partnerships with ORD. These include: direct collaboration on ORD project tasks, STL Superfund Extramural Projects, RARE, and Regional Sustainable Environmental Science (RESES) programs. The STL funds are for small immediate projects (less than $20,000) for specific regional needs (e.g., developing a workshop). RARE funds are allocated in an annual budget to each region and are used to respond to high-priority, near-term applied research needs of EPA's regions, state and local governments, and tribes. The RESES Research Program funds partnerships between ORD scientists and the regional offices to advance systems thinking in ways that integrate societal, environmental, and economic values and informs sustainable environmental outcomes for local communities. One example of a RESES project is described in the research poster titled "Understanding and Evaluating Ecosystem Goods and Services at Site Remediation Projects and Applying Their Benefits to Sustainability and Livability for Surrounding Communities." Another example of a RESES project is one to help the region understand how they can use the structured decision-making tool (DASEES). An example of direct ORD-regional collaboration with an ongoing

ORD project is described in the research poster titled "Tri-State Mining District Modeling, Technical and Decision Support."

Ms. Lynch concluded by stating that the regions highly value the technology transfer and translation that ORD provides into the actual work they are doing.

Dr. Pelka began her presentation by stating that the Great Lakes National Program Office (GLNPO) is different from the Regional Program Offices, but they have similar relationships with ORD. She stated that she wants to make clear how beneficial their relationship is with ORD to meeting their goals of restoration and revitalization of communities. She also stated that she wants to give a sense of the mechanistic underpinnings to their relationship with ORD to show why the collaboration and partnership is successful and to show how they want it to continue.

Dr. Pelka explained that the Great Lakes Water Quality Agreement (GLWQA) is the basis for the GLNPO. She described this as an agreement between the United States and Canada to restore and protect the waters of the Great Lakes. The Agreement provides a framework for identifying binational priorities and implementing actions that improve water quality. This agreement gives EPA the authority to work on Great Lakes issues. The Great Lakes Restoration Initiative (GLRI) put forth by the Obama Administration provides funding to clean up previously identified "toxic hot spots," or Areas of Concern (AOC). The GLRI is managed outside of the GLNPO and the funds go to other federal agencies as well. The total annual budget is about $300 to 400 million. She explained that some of the money goes toward grants and work out in the communities.

Dr. Pelka explained that the GLNPO is not a risk-based program. The AOCs were already defined in the GLWQA for a variety for reasons, some of which were not entirely technical. Their office is not looking to add any more. She explained that there is not a hazard ranking system for the AOCs, and there are no baseline risk assessments being performed. The AOCs are defined by Beneficial Use Impairments (BUIs). There are fourteen categories or types of impairments: restrictions on fish and wildlife consumption, tainting of fish and wildlife flavor, degraded fish and wildlife populations, fish tumors or other deformities, bird or animal deformities or reproductive problems, degradation of benthos, restrictions on dredging activities, eutrophication or undesirable algae, restrictions on drinking water consumption or taste and odor problems, beach closings, degradation of aesthetics, added costs to agriculture or industry, degradation of phytoplankton and zooplankton populations, and loss of fish and wildlife habitat.

Dr. Pelka emphasized that the GLNPO is specifically designed to be a community-based program. All AOCs have a local group to determine how to remove the BUIs and all of the decisions for an AOC have to go through this local group. There are different names for local groups, such as remedial action plan group and public advisory committee. Every action that GLNPO takes for an AOC is determined by what the local group wants to do. Dr. Pelka pointed out that some of the AOCs are large, such as entire cities or rivers.

The steps in AOC restoration are:

1. Define the necessary projects to remove BUIs. Projects for addressing the impairment and getting the system functioning are agreed to by state and local stakeholders. These projects are usually sediment remediation or habitat projects.

2. Implement the projects by various mechanisms. This usually happens through a combination of Great Lakes Legacy Act (GLLA) and GLRI mechanisms (GLLA is usually applied for sediment remediation projects and GLRI grants for habitat projects).
3. Assess the BUI status to determine if the projects accomplished their goals.
4. Remove all BUIs.
5. Delist the AOC, which is a State Department approved action.

Dr. Pelka displayed a map showing examples of areas around the Great Lakes where GLNPO had a strong partnership with ORD during the restoration process. These examples included the St. Louis River, Manistique River, Grand Calumet River, Maumee River, Ashtabula River, Buffalo, Torch Lake, and Deer Lake. Dr. Pelka pointed out that their program has only ten project managers, and over the last 11 years they oversaw the remediation of over 4 million cubic yards of sediment.

Dr. Pelka shared that the goal of the GLLA was to accelerate the pace of sediment remediation at Great Lakes AOCs. GLLA uses a partnership approach to conduct work in a non-enforcement capacity. She reiterated that this is a non-regulatory program and they do not need to identify responsible parties. The program is voluntary cost-share, and there is a minimum 35 percent non-federal match to fund the work. Matching funds have come from states, local entities, non-governmental organizations, and industries.

Dr. Pelka described GLNPO's partnership with ORD focused on the restoration of the Ashtabula River. ORD's work for this AOC was in a subarea of the dredge footprint. Sampling was conducted to determine the effectiveness of sediment remediation. A few years after this remediation, ORD provided critical assistance in designing a source control investigation and helping with a multi-agency sampling effort to removed three BUIs. ORD revealed innovative methods during this project.

Dr. Pelka states that there are many other examples of GLNPO's collaboration with ORD. She emphasized that GLNPO trusts ORD's opinion and ORD helps GLNPO understand how their technologies work. ORD is currently helping with the development of conceptual site models.

Dr. Pelka added that ORD has also been helpful throughout the Ottawa River restoration, specifically with the evaluation of remedy effectiveness through weight-of-evidence analysis to determine if remediation goals are met. ORD will sometimes work with GLNPO in the field conducting sampling. Dr. Pelka described the Manistique River project, another example of collaboration with ORD. A public availability session was held for scientists from ORD and other federal agencies to talk with the community and explain the restoration project. As part of the St. Louis River project, ORD is involved with remedy effectiveness work, including bio-uptake modeling. ORD also sits on the local groups to help them remove the BUIs.

SHC Overview of Project 3.61, Contaminated Sites
David Jewett, ORD

Dr. Jewett introduced himself as the Project Lead for SHC Project 3.61, Contaminated Sites. His colleague, Dennis Timberlake of NRMRL, is the Deputy Lead. Dr. Jewett stated that the overall goal of the project is to prevent and reduce human exposure to contaminants. Contaminated groundwater is present at 80 percent of Superfund sites, and cleanup can take decades to complete. Contaminated sediments are a factor in the degradation of beneficial uses (both human

health and ecosystem impairments). Vapor intrusion is a problem whereby contaminants can enter residences and structures presenting long-term health risks. The project encompasses Superfund sites, RCRA Corrective Action sites, and GLNPO AOCs. Project 3.61 is directly related to EPA's Strategic Goal 3–cleaning up communities and advancing sustainable development.

Project 3.61 provides the scientific foundation and technical knowledge for persons engaged in contaminated site cleanups. This project advances the science and engineering needed for the assessment, remediation, and reuse of contaminated sites. It produces deliverables directly related to OLEM and regional needs, as well as for the states, tribes, and others involved in environmental protection. It also provides highly valued technical expertise to the regions, program offices, states, tribes, and others. ORD provides not only the expertise, but also the "boots on the ground."

Dr. Jewett explained that there are five tasks in Project 3.61 (with task leads): technical support (John McKernan, NRMRL); contaminated groundwater research (Michael Brooks, NRMRL); contaminated sediment research (Lawrence Burkhard, NHEERL); vapor intrusion research (Brian Schumacher, NERL); and tools for evaluating spatio-temporal impacts on the environment (David Burden, NRMRL).

Dr. Jewett described Task 1, technical support. There are five technical support centers dedicated to providing high-quality, quick-response technical support to program offices, regional offices, and other tribal and state environmental protection authorities. Technical support centers also conduct Superfund-related research on innovative and novel ideas to solve emergent or on-going Superfund-related issues. Two of the technical support centers receive funding through Project 3.61, the Engineering Technical Support Center (Cincinnati, Ohio) and the Ground Water Technical Support Center (Ada, Oklahoma).

Dr. Jewett emphasized that ORD research is linked to Agency decisions. ORD applies best practices to field applications. ORD scientists work in the laboratory and in the field, and this helps them gain a better understanding of a given problem. As they are exposed to new aspects of the problems in the field, this helps the scientists better refine the technologies and also to see what is on the horizon (e.g., emerging contaminants and technologies).

Dr. Jewett presented several key accomplishments for Task 1. Annually, technical support centers provide expert reviews of feasibility studies, remedy selection, technology reviews, and technical document reviews. Most other requests involve the application of site-specific technologies, use or development of decision support tools, modeling activities, and statistical and/or analytical support. Technical support centers also develop issue papers, software, and other outputs.

Dr. Jewett presented the future directions for Task 1. Technical support centers will continue to provide valuable high quality technical assistance and produce high quality annual reports. There are also "lessons learned" documents, and a SharePoint site is under development.

Dr. Jewett described Task 2 (contaminated groundwater research). Contaminated groundwater directly impacts and limits both private and community water supplies. Dr. Jewett stated that ORD tries to help the regions and states understand the issues. ORD conducts basic and applied research to address knowledge gaps related to characterization and restoration of contaminated

groundwater resources. This includes contaminant fate and transport and understanding the chemical, physical, and biological processes. ORD is also designing technologies for site characterization and remediation. Dr. Jewett presented that the efforts consist of laboratory and field research, model and tool development, with activities focusing on flux-based site management, back diffusion, *in situ* chemical oxidation, emulsified zero-valent iron, inorganic contaminants, leaching framework for organic constituents, and the use of geophysics to characterize groundwater and contaminant distribution. Dr. Jewett stated that OLEM and the regions prioritize their needs, and ORD works to understand how the different tasks under Project 3.61 meet those needs.

Dr. Jewett shared several key accomplishments for Task 2. A workshop was held in 2016 on the feasibility of developing a framework for evaluating leaching potential of semi- and non-volatile organic contaminant. A book chapter reviewing application of additives used in bioremediation of chlorinated solvents and fuels for groundwater and soils was developed. In 2017, a journal article titled "Critical Assessment of Oxidant Volume Design and post-ISCO CVOC Rebound and Changes in Aquifer Permeability" will be published.

Dr. Jewett presented the future directions for Task 2. ORD will continue to produce products that support EPA program managers, remedial project managers, and other site management personnel (tribes, states, local authorities). OLRD will engage communities to protect public health and natural resources and will restore contaminated groundwater resources.

Dr. Jewett described Task 3 (contaminated sediments research). He shared that there is a lot of work happening under this task, and each task within this project has a champion from the program and regional offices, including Ms. Lynch and Dr. Pelka. These champions work directly with ORD to help them better understand the problems being faced by the programs and regions. Dr. Jewett added that ORD is working to improve their connections with their program partners and regional offices. Contaminated sediment research includes laboratory studies and field studies at contaminated sites. These laboratory studies include method development for measuring toxicity and bioaccumulation, as well as the design and use of passive samplers. Field studies help develop methods, metrics, and approaches to identity, track, and apportion contaminant sources, as well as evaluate the effectiveness of contaminated sediment remediation alternatives and their associated impacts.

Dr. Jewett shared several key accomplishments for this task. Methods for sediment toxicity tests were revised and improved. ORD also developed interstitial water measurements using passive sampling. They used passive samplers as surrogates for biomonitoring organisms and performed field demonstration and validation. They developed a guidance document for use at Superfund sites. ORD also validated the use of benthic species for documenting remedy effectiveness.

Dr. Jewett presented the future directions for Task 3. ORD will improve sediment toxicity testing implementation and interpretation of results at Superfund sites. ORD will also develop source identification and tracking methods and guidance. Uncertainties in the prediction of chemical residues in fish and shellfish will be reduced. ORD will develop and validate tools and measures for documenting remedy and restoration effectiveness.

Dr. Jewett described Task 4, vapor intrusion research, which occurs when there is a migration of vapor-forming chemicals from any subsurface source into an overlying structure. Vapor intrusion

into residences and other occupied buildings is a potential problem as soil and groundwater contaminants may volatilize and be transported to the soil surface. Vapor intrusion research includes understanding vapor migration pathways (distribution and movement of vapors), sample collection techniques to better characterize intrusion of vapors, materials, probe/well installation, timing of sampling events, use of soil vapor extraction systems to prevent and reduce vapor intrusion, and mitigation system effectiveness.

Dr. Jewett stated that the key product for this task was the technical guide that ORD worked with OLEM to produce. He pointed out that were several ORD milestones that led up to the technical guide, including journal articles and EPA publications that were consolidated into the guide. The subjects of those publications included the effect of equilibration time and tubing material on soil gas measurements, temporary versus permanent sub-slab ports, different ways to sample the vapors, and the available mitigation technologies.

Dr. Jewett presented several key accomplishments for Task 4. One key accomplishment is a technical guide for "Assessing and Mitigating Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air (Publication 9200.2-154)." This technical guide describes the effect of equilibration time and tubing material on soil gas measurements, the use of temporary versus permanent sub-slab ports, the assessment of mitigation systems on vapor intrusion. The technical guide also compares vapor intrusion mitigation system performance for VOCs and radon. Simple, efficient, and rapid methods to determine potential for vapor intrusion into the home are also provided.

Dr. Jewett presented the future directions for Task 4. The use of soil vapor extraction to control vapor intrusion will be explored along with the effect of impervious surfaces on the distribution and remediation of VOCs. The effectiveness of portable adsorption systems for removing chlorinated VOCs will be assessed. ORD will consider air quality issues related to the use of multiple sub-slab depressurization systems to mitigate vapor intrusion on the neighborhood scale. Vapor intrusion in large commercial buildings will be investigated.

Dr. Jewett described Task 5, tools for evaluating spatio-temporal impacts on environment. He explained that there are many activities that have led to the development of decision support tools, models, and software applications. These tools are used by scientists, technical staff, and communities to evaluate temporal and spatial impacts that contaminated sites may have on the environment and to assess and predict temporal and spatial changes in aquifer-based water supplies related to community water supplies. There are tools dealing with geophysics and GIS decision support systems. Dr. Jewett commented that there is collaboration going on with in this task, across the various tasks of Project 3.61 and with other projects (e.g., SHC Projects 2.63 and 2.61). ORD and SHC are collaborating on topics including the human well-being index and bioaccumulation. Dr. Jewett emphasized that they continue to look for ways to collaborate with other SHC projects as well as projects from different research programs, such as the SSWR Research Program.

Dr. Jewett described anticipated accomplishments for this task. GIS will be applied to decision support systems to assist communities with making groundwater resource decisions. Spatial decision support system approaches for both detailed and screening impacts of contaminated sites are needed, as are mapping-based evaluation of locations and impacts to private drinking water wells in the context of aquifer vulnerability.

Dr. Jewett presented the future directions for Task 5. A spatial assessment of contaminated groundwater at contaminated sites near vulnerable drinking water supplies will be conducted. ORD will apply graphical user interface for simulating the transport of volatile organic compounds in the vadose zone. GIS-mapping and statistical analyses will also be applied to identify communities and populations disproportionately impacted by climate change-vulnerable contaminated sites. ORD will identify key factors and conduct an exposure assessment case study of a community disproportionately impacted by climate-vulnerable contaminated sites. These last two future directions represent a cross-collaboration with researchers in SHC Project 2.63 (Community Well-Being: Public Health and Ecosystems Goods and Services).

Dr. Jewett clarified that OSWER became OLEM. It is the same program office, just a new name.

Poster Session
SHC Principal Investigators and Subcommittee

The subcommittee attended the research poster session, reconvening for the panel discussion to share key observations and related discussions.

Partner Panel Discussion
Dan Powell, OLEM; Kira Lynch, Region 10 STL/ORD; Amy Pelka, Great Lakes National Program Office; Diana Cutt, Region 2 STL/ORD

Dr. Flint reconvened the meeting and added that she thought the poster session on Project 3.61 was great. She noted that the subcommittee would have the opportunity to ask questions following the panelists' comments.

Dr. Flint invited the panelists to make highlighting statements followed by an open discussion with all participants. Mr. Powell commented that Mr. Michael Scozzafava would be joining the meeting later over the phone.

Dr. Pelka discussed the content of the last slide of her presentation regarding the 3 R's her program used—remediation (R1), restoration (R2) and revitalization (R3), which she explained represent her program's successes, relationship and partnership with ORD, and the future of the program. First, Dr. Pelka explained that remedy effectiveness ("remediation" or "R1") represented what the program was successful in achieving and whether the program achieved its initial goals. Second, she explained that restoration effectiveness ("restoration" or "R2") was an area where she would like to see more interactions with ORD. Restoration was important to the different communities and entities GLNPO worked with. Dr. Pelka explained that there was a high value placed on habitat projects because they were immediately understandable and translated into increased use. Third, Dr. Pelka explained that revitalization ("R3"), which included economics, social science, and metrics of project success, was the direction she would like the program to head in but added that she thought this would require assistance from ORD.

Dr. Pelka summarized that remediation included strong, equal collaboration; restoration was still working to pinpoint areas that needed help and revitalization was an area she recommended ORD lead because of their greater expertise. She added that revitalization was an area where GLNPO was unsure of how to measure and would require help from ORD to identify proper metrics.

Dr. Geller reminded the participants that the GLNPO mission legally stops at remediation and he questioned how much consideration and resources should be devoted towards restoration effectiveness. Dr. Pelka agreed that Dr. Geller raised a good point. However, she clarified that the program was legally encouraged to do restoration, but the current metrics of success used were basic. She provided examples of the basic metrics, which included acres of restored land, wetlands, shoreline, and number of fish and shells. Dr. Pelka noted the GLNPO was still unsure which metrics were the best to use and at what time points those metrics should be measured.

Dr. Geller commented on more advanced metrics, including ecosystem services restored or ecosystem service evaluation, and asked whether Ms. Catlin Nigrelli, a social scientist, was working with Dr. Pelka on revitalization. Dr. Pelka responded that Ms. Nigrelli was involved in helping with social sciences on GLLA projects by providing context, holding focus groups, conducting perception research, and more. Dr. Pelka explained that Ms. Nigrelli's work helped understand the values placed on certain areas. However, she noted the need to continue to delve further into areas, with the help of ORD, including the sound economic analysis of ecosystem services, proof-of-concepts, and case studies so that the information could be used in metrics of success.

Dr. Cervero noted some of the economic development benefits of remediating sites, including job creation, reduced suburban sprawling effects, and reenergized burdened districts. He expanded on the benefits of reduced suburban sprawling effects, including conservation of existing greenspace, protecting biodiversity, reducing habitat fragmentation, and more. He explained that metrics of restored land should not only include acres, but also include the benefit of protecting green spaces that would have otherwise been developed. Dr. Cervero suggested developing a more robust evaluation framework to assess the full value of reduced urban sprawl. Dr. Dannenberg added that this benefit framework was necessary for making it attractive to states, in addition to private industry, to build on that land. Dr. Cervero further reiterated that there were second order environmental benefits of remediating sites beyond the economic benefits of creating jobs in the urban center.

Mr. Powell underscored some key important points from OLEM's perspective. The first was to ensure the continued viability of the research pipeline to develop new technologies and tools and for ORD to continue to provide world class experts as a resource to help bridge the gap between research and applications in the field, both at the site and programmatic levels. The second key point was to continue to focus on the application of work to determine which tools to use in different situations, and the third was to maintain the evaluation capabilities provided by ORD, specifically the compilation of information that supported the application of work. Lastly, Mr. Powell explained the fourth key point to increase collaboration within ORD and across other federal agencies, including the Department of Energy, Department of Defense, and the National Institute of Environmental Health Sciences, and use that collaboration to better leverage research across agencies.

Ms. Lynch commented on the wide variety of issues OLEM faced when attempting to characterize and make decisions about contaminated sites and the high value put on the expertise of ORD's scientists, which ensured that OLEM and the community had confidence in their decisions. Ms. Cutt added that it was helpful to have an ORD scientist in the field when communicating with concerned community members so they could explain remediation options

and the reasoning behind decisions. She further noted that she hoped to see more involvement of the partners earlier on in the strategic planning process.

Dr. Flint asked if Mr. Scozzafava was on the phone and, hearing that he was not, opened up the conversation to the subcommittee members.

Dr. Irwin commented that there needed to be significant investment in social scientists in the future in order to achieve the goal of revitalization. While she loved the inclusion of the three R's, she noted that achievement of revitalization seemed aspirational at this time, and the sole resource of one social scientist helping ORD would be insufficient. Dr. Irwin asked the rest of the program partners if they agreed with this vision. Ms. Lynch commented that there was a robust revitalization evaluation program in the Superfund program. She noted that groups within the Superfund Office had worked on quantitative measures of remediation benefits, such as new jobs created, the economic value of redeveloping already industrialized sites, and the benefit of preserving green fields. Dr. Raffaele added that OLEM had a group of social scientists within the Office that develop indicators to assess the impact of sites on the community. She also noted that work in the Brownfields Program included identifying and evaluating metrics for the revitalization of their sites. Mr. Powell added that under the Government Performance Results Act, there was tracking of site-wide acreage ready for reuse as a performance metric in the Superfund program. He noted that the EPA website included a section on land revitalization, which provided more information. He also noted the Superfund's Job Training Initiative that trained workers in hazardous waste cleanup with the goal of enabling use of those skill sets in the future.

Dr. Dannenberg asked if there were measurements available that helped determine if project outcomes were ready for use by end-users. Mr. Powell responded that there were a few places where sites had been reused for a variety of different purposes. He provided the example of the Brownfield underground storage tank fields and explained a report was issued that included a land reuse list. He noted that he was interested in learning about studies that looked at the value of reusing land in the inner-city. Dr. Cervero added that sprawl included cost so urban containment had huge environmental benefits and a more robust evaluation framework to assess the full value would be beneficial.

Dr. Geller commented on metrics that SHC was working towards developing, including holistic well-being, environmental quality, health promotion, and ecological services. He asked how those indices contributed to the sense of place. He recognized that the sense of place was difficult to measure and asked if those indices were too ill-defined to include in an annual report. Dr. Raffaele mentioned that there were several SHC projects that dealt with these issues that were not included in this particular project. Mr. Powell added that indices of well-being and environmental quality assessing progress in environmental justice or sense of place would be better suited for program wide metrics rather than project specific metrics. Dr. Pelka agreed and added that this was why she thought a case study would be helpful to develop program-wide metrics of progress.

Dr. Meyer returned to the topic of revitalization issues, highlighting that revitalization projects needed to have public support but would not if they couldn't be economically justified. He reminded the partners of a similar question posed 10 years ago regarding the depletion of state underground storage tanks. In this case, public support was not generated because economic

return of site cleanup could not be demonstrated. He stressed the need to recognize that the revitalization process was not only formally within EPA's rubric, but it was also an economic development question. He underscored that the focus should be less on how ORD could inform people about remediation and more about how EPA related to other non-federal agencies that play a role in generating revitalization. Building these relationships between agencies would generate a new form of clientele and progress EPA's objectives. He also noted the need to return to serving communities because they had a primary interest in their own economic revitalization, and not the agencies and states.

Dr. Irwin questioned whether there was sufficient integration across research in various project areas to inform large questions of community sustainability and environmental justice, and therefore properly address charge question 2. Dr. Geller responded that he believed project and research integration was already taking place, especially when addressing subjects such as the benefits of improved ecosystem services and wellbeing in Project 3.61. Dr. Geller noted that there were still areas to improve but this was a recommendation that the subcommittee could include in their report so SHC could continue to drive those project integrations forward. Dr. Jewett added that integration across programs was happening, specifically with projects that used the DASEES tool and groundwater projects within ORD's Office of SSWR.

Dr. Rubin noted two posters that struck him as outstanding. The first was Mr. Mike Kravitz's poster that looked at ecosystem services for a contaminated creek that was lead heavy from mining. The second poster was from Dr. Mills on the Great Lakes, which was a collaborative effort between ORD and the community. The community requested assistance for site revitalization and supplemented the funds ORD provided for the restoration. The community initiation empowered them and ensured that they had a sense of responsibility for making a difference for themselves. Dr. Rubin explained that each community was different and had different objectives, so more community involvement during the site remediation process could be helpful and make measuring success easier. He also added that brownfields were an area where people could request funding to invest in revitalizing their area, which as different from the Superfund sites. Dr. Rubin reiterated that the partnership between the funders and the communities was important.

Dr. Cervero explained that EPA, the Department of Housing and Urban Development (HUD), and the Department of Defense had a partnership about revitalization, land-use, and urban versus green land development that included discussions on transportation and sustainable community partnerships. However, he noted that the partnership was focused on polices more than coordinating research or community efforts. He added that HUD could have information on the hidden costs associated with development of green fields (e.g., biodiversity loss), which was an area that needed to be further explored. Dr. Cervero noted that the posters contained some great science, but he was struck by the lack of community and grassroots people included in the consumers of SHC's support tools for ecosystems and suggested that ORD communicate more with the regions in order to engage more tool users and promote the exchange of information.

Mr. Powell commented that some of the contaminated site research objectives included developing tools to improve site characterization and cleanup. He explained that the tools could help characterize sites more quickly and improve understanding of contaminates located in discrete areas that were inaccessible before. The tools could potentially help improve site

planning, lower costs, and expedite remediation efforts to reduce human health risks and mitigate environmental damage. It could also build confidence that the sites had been cleaned up.

Dr. Flint asked for clarification on the role of the states. She explained that the word "site" implied place-based efforts and noted that, while there had been discussion about communities, she was still unclear how the states fit into the community site and ORD work. Ms. Lynch responded that this was a good point, and she tried to address it at the beginning of her presentation. Ms. Lynch explained that many of the sites were located on tribal lands which require collaboration with tribal governments. She mentioned various examples, including Quarter Lane and Bunker Hill sites, and explained that multiple tribes, states, stakeholders and community members all weighed in on the decision process at different levels. Ms. Lynch added that OLEM saw value in using the ecosystem services tool to communicate with diverse stakeholder groups, provide information about what ecosystem services were available, and to receive stakeholder input during the decision process. Ms. Lynch explained that the tools were not only used to support the regions, but were also opportunities to bring in large diverse stakeholder groups to assist with the decision process at the sites. Ms. Lynch also emphasized Mr. Powell's point that it was essential to understand the acute and chronic problems facing sites before OLEM could tackle questions about revitalization. She provided the example of trichloroethylene vapor intrusion, a problem not understood until recently, that illustrated how ORD's ongoing research on contaminated site problems should be used as a building block for addressing later questions on topics like revitalization. Ms. Cutt agreed and added that ultimately the goal was to work to clean up these sites faster with lower costs.

Dr. Geller agreed with Mr. Powell and Ms. Lynch, and added that SHC's scientists are experts in remediation, passive sampling, biological sampling, and site characterization and need to continue to do those things well. He added that revitalization and well-being are novel "ultimate outcomes" that are goals SHC is headed towards.

BOSC Discussion
Subcommittee

Dr. Flint invited the BOSC members to share their observations and questions from the poster review.

Dr. Dannenberg asked for clarity on the role of environmental justice. While he recognized that environmental justice was implicit in all of SHC's work, he asked for clarity on how environmental justice was explicitly being examined and its role in setting priorities and policies. Mr. Kelly answered that this was difficult to address because it crossed many disciplines. He added that, since President Clinton signed an Executive Order 22 years ago to address this, there were still state-level efforts to identify the best tools to address these issues. Dr. Flint explained the helpful application of the DASEES model that included embedded social network analysis, which helped facilitate the identification of actors involved and who are omitted in the decision-making process. She explained that this would be a helpful tool for identifying overburdened communities that were left out.

Dr. Flint noted further benefits of the DASEES tool, explaining that DASEES is being used at multiple sites to help with contamination issues, but could also be used in different cases to track objectives. Project objectives could then be compared using a meta-analytic approach to learn

from older cases, allowing new sites to use previous approaches as module. Dr. Flint further commented that while the lessons learned were often highlighted in the posters, there was no evidence in the text material about if/how those lesson learned were being compiled, what actions were being taken, or if they were being tracked over time and/or how do we know if a lesson learned here corresponds to a lesson learned elsewhere. Dr. Flint added that development of meta-analytic tools to track lessons learned over time across projects and applications could be helpful in evaluating progress and outcomes. She further noted possible obstacles for implementing these tools, including limited staff resources and money.

Dr. Nance commented that she was impressed with the DASEES social network analysis and the Great Lakes work presented. She noted that these were the two posters that stuck out as explicitly providing some information that could be used to answer the charge questions. Dr. Nance stated that she was surprised that it was difficult to find explicit answers in the posters addressing the charge questions because of the great talent among the SHC scientists. Dr. Flint responded that she did not believe it was the job of the scientists to directly articulate the charge question responses, and it was up to the subcommittee to interpret based on their observations.

Dr. Geller explained the two reasons behind charge question 2. The first was to prompt the continued assistance from the subcommittee regarding the movement of the SHC program from site remediation to community revitalization and the investigation of those connections. The second reason was for the subcommittee to continue to brainstorm future steps for SHC to address this transition. Dr. Geller further noted that Dr. Nance's point was important because, as the SHC program evolved and incorporated environmental justice into their research, the program would likely move beyond the traditional focus of only looking at contaminants themselves and how to address them towards looking at the actual receptors (e.g., the people and organisms affected and the routes of exposure). Dr. Geller explained that this had previously not been the focus of the SHC program and stressed the necessary consideration of the receptors themselves when trying to address environmental justice issues.

Dr. Raffaele commented that OLEM had an active environmental justice piece of their program and that many of their sites were located in environmental justice communities. She noted that OLEM had a special group within the Superfund Program that worked closely with the communities at sites to identify issues. This group helped OLEM take additional community exposures into account and change their remedy for sites based on community input. However, Dr. Raffaele noted that this site-specific work was less aligned with SHC work, which focused more on finding better ways to clean up the sites. She added that there was a significant amount of work being done within SHC to address the environmental justice question, which may not be obvious from the posters. Dr. Flint further highlighted the importance of the word "over-burdened" when discussing environmental justice issues. She explained that Topic 3 is focused on reducing the burden of contamination on communities thus, this effort to reduce the inequitable distribution of burden inherently addresses environmental justice issues.

Dr. Meyer noted that the poster with the spreadsheet for the environmental footprint analysis listed six different criteria, but he had learned there were now twenty-two criteria being considered (e.g., the amount of energy being used and the hazard pollutants created in the remediation process). He explained that any community could look at data on alternative mitigation technique and select the technique with the least negative impact on the

environmental concerns most important to that particular community. Therefore, this effort provided a tool for communities to select the method of cleanup that was best for them, particularly for environmental justice communities. Additionally, Dr. Meyer added that he observed the poster on the opposite side of the poster on "ORD Technical Support and EPA Regions: Successful Partnerships in Cleaning up Communities." The partnership poster featured a middle panel discussing the process of advising and optimizing remedy selection. He explained that he was unclear who was responsible for optimizing the remedy selection. He questioned who is doing the optimizing, as the optimal remedy depended on multiple factors, including the site ground and the subsurface conditions or the community around the site. He expressed concern with the role of scientists alone determining what was optimal on the ground, and instead suggested that better-informed communities have a greater role in picking what is optimal for them. He questioned what the boundary of ORD's responsibility was in this process.

Mr. Powell commented by providing the example of the Superfund Green Remediation Strategy and its relation to environmental justice communities in order to illustrate how those communities were impacted by many factors in addition to contaminants. Mr. Powell noted that one area to focus on was the environmental footprint and impact of the remedies on environmental justice communities. Mr. Powell explained that the green remediation took these additional factors into account, which reflected the possibility of a greater impact from site contaminants on environmental justice communities compared to other communities. Mr. Powell added that the Spreadsheets for Environmental Footprint Analysis (SEFA) tool system helped in understanding where the impacts were occurring. He explained that optimizing the remedy was aimed at assessing if the chosen remedy was working as intended over time so as to determine if there were improvements for remediation that could help inform future site characterization. He mentioned that the optimization program had looked at 200 sites to assess lessons learned and target areas for improvement. He clarified that optimization was about improving the remedy and not about remedy selection, and added that this process was based on the nine NCP criteria previously mentioned. Ms. Lynch added that one of the nine criteria used for remedy selection is state and community acceptance, and stressed that this was indeed taken into consideration when balancing factors to select proper remedy strategies.

Mr. Kelly commented that he agreed there was good science going on, but noted some continued areas of concern at the state level, including vapor intrusion, sediment and ground water contamination. He stressed that a considerable amount of work was still needed in these areas as the issues persist. ORD needs to continue engaging with states and the proper communication was essential for identifying and strategizing solutions for problems in the future.

Wrap-up and Adjourn
Courtney Flint, Vice-Chair; Jace Cujé, DFO

Dr. Flint thanked the partners and ORD scientists for their participation and engagement. Dr. Flint also thanked Dr. Geller and his team for their support, and for responding the subcommittee's request for a deeper dive.

Dr. Geller echoed Dr. Flint's comments and expressed his gratitude for everyone's effort throughout this process. Dr. Geller explained that SHC had a responsibility within ORD's matrix to communicate with OLEM and the regions. The technical work is conducted by scientists and engineers in both programs. Dr. Geller noted that while ORD was engaged in foundational and

applied science, the regions were also conducting science for implementation of the EPA programs. The program offices are full of researchers applying science to the development of rules and regulations. This represents a tremendous collaborative scientific endeavor. In the future, the task is to continue to develop and forge existing relationships between ORD, OLEM, and the regions. The challenge of communication is enormous and proper communication should be guarded and encouraged. Communication should be maintained when setting goals in the future.

Mr. Cujé echoed Dr. Geller and Dr. Flint's comments and thanked everyone for their hard work. He invited the subcommittee to reach out to him to obtain electronic copies of the posters.

Friday, November 4, 2016

DFO Reconvene Meeting, Attendance

Jace Cujé, DFO

J. Cujé said that he appreciated the subcommittee's engagement and looked forward to a day of deliberations.

Dr. Flint asked the BOSC members to state their departure times. Some BOSC members need to leave early, so Dr. Flint proposed adjourning the meeting at 1:15 PM to accommodate subcommittee members with earlier departure times. Dr. Flint confirmed that Dr. BenDor was present via phone.

Dr. Geller welcomed the subcommittee and other participants to the meeting and thanked them for their time and effort preparing for and participating in the discussions. He introduced Ms. Mazur, who is the lead on the PACT formation.

SHC Partner Alliance and Coordination Team

Sarah Mazur, Acting Deputy National Program Director, SHC

Ms. Mazur shared that each National Research Program is standing up PACTs as part of the implementation of the 2016-2019 StRAPs. The goal of the Partner Alliance and Coordination Teams (PACTs) is to foster communication between the program and regional partners. Another goal of the PACTs is to nudge the Agency forward and to push forward the goals of the SHC. Each PACT includes representatives from across the Agency.

Ms. Mazur provided an overview of the SHC PACT development process. First, a team was established to develop the PACT concept. Members of the team included representatives from ORD, the program office, and the regional office. Next, the team shared ideas, received feedback, refined these ideas, and built support for the PACT. During this time, the development team reached out to additional partners within ORD and the program and regional offices. Partner nominations for PACT participants were received in September 2016, and roll out plans are currently being developed. Ms. Mazur noted that Dr. Geller sent out a request for PACT member nominations and provided details on expectations for members. Kickoff meetings will be held in late November and December 2016.

Ms. Mazur noted that there are three SHC PACTs: Health-Eco Integration for Community Well-being; Cleaning up Contaminated Sites; and Sustainable Solutions. Specific projects are housed within each of the three PACTs. Ms. Mazur described PACT functions, which are in a circular form. The approach is two-pronged where the PACTs provide the higher-level strategic

coordination and facilitate technical level dialogue. Strategic level priority setting informs research at a higher level.

Ms. Mazur reviewed specific goals of the SHC PACTs. Additional goals include leveraging expertise and resources; increasing transparency; providing opportunities for program and regional offices to inform future research directions; coordinate science translation, communications, and outreach; and gather feedback on the utility of research projects.

Ms. Mazur summarized the SHC PACT participants as representing diverse groups and perspectives. The Health-Eco Integration for Community Well-being PACT is led by Ms. Mazur and has 40 participants. The Cleaning up Contaminated Sites PACT is led by Ms. Chu and has 15 participants. The Sustainable Solutions PACT is led by M. McCullough and has 38 participants.

Ms. Mazur shared the results of a survey on PACTs. A survey was administered to SHC partners in June 2016, and the purpose of the survey was to establish a baseline for where the group is now. The survey asked partners for input to help shape SHC's PACTs. The partners identified up to three activities from a list that they consider to be the most important functions of PACTs. The top three activities were to prioritize research needs, disseminate research to potential agency users, and jointly define research outputs. The survey results will help inform the process and the program office is interested in getting more granularity to better understand how PACTs are working. SHC is considering distributing a survey of questions ahead of each meeting and having a discussion at each meeting about the current state of affairs. SHC wants to ensure that the PACT works for everybody. Time is being spent early on to determine how the group can move forward with these PACTs. There is interest in sharing research and FY16 deliverables as well as giving others a chance to provide input on deliverables.

Dr. Flint stated that she was excited to see this work being done because it was discussed during the SHC BOSC meeting one year ago.

Dr. Dannenberg asked if "partners" referred to other partners at EPA or partners at the state or local level. Ms. Mazur responded that the current focus is on internal partners from program and regional offices, but the PACT is considering how to work with this group to reach out to external stakeholders as well.

Dr. Irwin agreed that this work was exciting. She would have liked to see this presentation on the first day of the meeting. She noted that a SHC program member commented that they wanted be more involved in the development of the StRAP. She asked if the PACTs address that concern. Ms. Mazur responded that the PACTs would address this concern and allow for more interaction during the development of the next StRAP.

Dr. Rubin asked for more information on the involvement of regional offices. Ms. Mazur responded that it can be challenging to incorporate the needs of each region because each region has different concerns. The SHC PACTs will include regional liaisons from relevant program areas, such as the regional STLs, and other areas where there are cross-regional networks. SHC is counting on PACT members to act as liaisons to their different regional offices and interest areas so they can share information with their broader groups. The PACTs will also act as technical contacts and resources for the regions in their respective areas of expertise.

Dr. Geller added that the sustainability coordinators work throughout the regions and are connected to the Office of Sustainable Communities. He explained that ORD and the Agency has a lead region process, with the lead region changing every two years. For example, Region 3 will act as the lead region for Superfund, and Region 1 will be the lead region for RCRA. The lead region serves as a point of contact for all of the regions and their concerns.

Dr. Flint noted that Ms. Mazur discussed getting feedback. She asked if this process was viewed as something that filled a gap or if a process for gathering feedback already existed amongst the projects and networks. Ms. Mazur responded that the PACTs received positive feedback that the survey did fill a gap, but more technical-minded staff wondered how this feedback would help fill a gap. For example, the Cleaning up Contaminated Sites PACT is already tight knit, having strong interactions and networks of communication. Dr. Raffaele added that the level of connections was already tight for some offices and communication was high, but that is not the case for all offices. Moving forward, the SHC PACTs may short-circuit the rounds of communication.

Dr. Geller stated that ORD is working toward becoming a more learning-focused organization and needs to participate in other groups' strategic planning in a way that traditionally has not occurred. ORD wants to reduce the time spent putting out fires because there will be more involvement in strategic planning and other processes from the start.

Dr. Irwin pointed out that the main goal of the PACTs appears to be to increase communication. She recalled that Ms. Mazur stated that two of the three programs are cross-connected and there is a push to increase communication between these programs so they can learn from each other. Dr. Irwin wondered why the Cleaning up Contaminated Sites PACT is not that way. She asked what makes this group special. Ms. Mazur replied that the Cleaning up Contaminated Sites PACT is more focused on the needs of OLEM and is targeted with respect to their internal partners. Dr. Irwin stated that part of what the subcommittee heard yesterday is that the Cleaning up Contaminated Sites Program has some social scientists that could benefit other groups. She suggested fostering more cross-path coordination. Dr. Irwin also suggested expanding this group to include contaminated sites "and health" and "and revitalization." Ms. Mazur agreed that more cross connection is important and she noted that some participants are in multiple PACTs.

Dr. Geller added that SHC does not want to limit participants and participants are welcome to join multiple PACTs. This will be encouraged moving forward.

Mr. Naud described the use of network analysis to measure change and to determine if an increase in the density of the network creates an impact. He shared this has been useful to his organization as a measure of increased network connections. There could be an opportunity early on to tap into social science. Network analysis also indicates who the really connected people are. These people should be brought forward for leadership. Dr. Geller pointed out that in the DASEES poster, Brian Dyson developed a social network analysis tool. This would be a great baseline and network to consider.

Dr. Flint shared that the BOSC Executive Committee is doing a deep dive into research program evaluation. Those tools are set up to look for baseline considerations and short-term and long-term impacts within the organization. Tools, templates, and surveys already exist and are

available online. Dr. Flint encouraged the SHC to utilize online resources provided by the University of Wisconsin Extension and Susan Cousins of the BOSC.

Dr. Meyer stated that it is important that the survey is thoughtful, but it sounds like that is already happening.

Dr. Dannenberg noted that ASTSWMO would be good external partners. Ms. Mazur said that SHC works with other external stakeholders outside of the PACTs.

Dr. Martín pointed out that the three PACTs do not match the five StRAP project areas. He asked why the PACTs are not aligned to the project areas. Dr. Geller replied that there were many ways to organize the program. One example is putting sustainable materials management and beneficial use into the sustainability group because the goal is to develop circular economies and redefine waste into resources. Thus, sustainable materials management needs to be placed in that group. The workforce focused in this area is in NRMRL. He's not sure if this organization represents a failure or a matrix within a matrix.

Dr. Raffaele asked Dr. Martín to think about the way the topics are organized as a work in progress because flexibility is needed. SHC will not understand the synergies of the PACTs until they get together and start working. The other issue is the availability of the PACT members. It is important that the projects that interest members be part of the same group. Dr. Raffaele is optimistic that ORD will be open to adjusting the topics in each group as work progresses. Dr. Geller pointed out that the program office is interested in efficiency. He added that, as the groups develop, SHC may see the PACTs coalescing across national research programs. Some topics, such as children's health and climate change, will be addressed across multiple research programs. The process is evolving. While ORD understands that topic-based discussions will provide the best value, there are challenges with drawing it all together. At the next BOSC meeting, the PACTs may be shifted, with Dr. Raffaele stating that she is unsure if these topic areas will appear in the next iteration of the StRAP.

BOSC Subcommittee Discussion and EPA Response to BOSC's Questions
SHC Leadership; Subcommittee

Dr. Flint stated that she wanted to make sure that the subcommittee has the proper bounded space for responding to the charge questions. She asked Dr. Geller to provide any context within ORD about what the subcommittee should not incorporate in their evaluations.

Dr. Geller stated that he hoped the structure of this review served the subcommittee well. Dr. Taylor and the other presenters provided a clear and valuable description of the missions of ORCR, OSRTI, and other parts of OLEM. Some of the subcommittee's discussion focused on policy issues and research. Dr. Geller asked the subcommittee to separate issues of policy from research and development when considering the charge questions. Scientists need to be aware of that line because science should be as uninfluenced by policy issues as possible. Policy and community engagement in rulemaking should not be considered. Community participation and citizen science are appropriate to consider. Consideration of these boundaries and this separation will increase the utility of the report for ORD.

Dr. Martín agreed with these boundaries, but stated that the subcommittee should consider organizational issues such as resources and staffing.

Dr. Irwin asked if discussion or judgment about how well research informs policy is within scope. Dr. Geller replied that these considerations are within scope, especially in terms of mechanisms of research translation to inform practitioners and policy makers.

Dr. Rubin asked if the needs informing the research, such as community needs, are within scope. The research drives the policy and the community needs should drive the research, Dr. Geller responded that this may be independent of the regulatory process. Considerations about who SHC is talking to and gathering information from to inform research needs is also within scope.

Dr. Flint asked if the BOSC has any remaining questions about the presentations and discussions over the past two days. She requested that the subcommittee ask clarifying questions rather than provide comments.

Mr. Naud asked how SHC was preparing for succession planning. Dr. Geller responded that succession planning is fair game for discussion. The Agency is aware of this and there are steps coming out of the White House Office of Personnel Management. The current plan for ORD is to implement phased retirement to ensure knowledge transfer. Staff doing phased retirement must dedicate 20 percent of their time mentoring new staff. ORD laboratories and research centers are primarily responsible for hiring and SHC works together with them to identify gaps and changing demands for the workforce.

Dr. Dannenberg asked if there were fellowships for bringing in new talent to ORD. Dr. Geller responded that ORD had a buyout several years ago that opened up the space to hire approximately 250 people. The majority of these new-hires were reserved for the federal post-doctoral program. Dr. Geller hoped these staff could be hired permanently. ORD is also looking at Title 42 hiring authority, which is often used to hire the best talent. Other science organizations use Title 42 to hire people on a five-year rolling basis. This hiring strategy would provide ORD with the ability to hire younger scientists without the promise of tenure.

Dr. Nance asked where to find the list of sustainability and environmental justice goals that should be considered when responding to charge question 2. Dr. Geller responded that the Environmental Justice 2020 Action Agenda was publically released last week and the Environmental Justice Research Roadmap was reviewed by the BOSC Executive Committee this week. With respect to longer-term sustainability goals, SHC is relying on the expertise of the subcommittee. He asked the subcommittee to consider mismatches between OLEMs near-term needs, anticipated long-term needs, and the proposed research. Dr. Flint agreed that the subcommittee should draw from its members' body of knowledge on sustainability goals. Ms. McCullough added that when SHC sent out the call for subcommittee members, the intention was to gain insight on their knowledgebase and practice on sustainability.

Dr. Martín asked for more information on SHC staffing load. Dr. Geller replied that there are between 300 and 325 full time employees on ORD's staff. The number of ORD staff has dropped recently because the Agency's whole ceiling dropped. An additional 100 people provide administrative support to ORD and the Agency. Dr. Geller did not anticipate major changes to the number of staff in the near future.

Dr. Martín asked what proportion of SHC's work is directed towards OLEM. Ms. Sjogren replied that there are three projects either that get money either from S&T, LUST, or oil and spills. The S&T money is discretionary. For fiscal year 2016, 2.7 percent of the S&T

discretionary money went to Project 3.61, 6 percent of the S and T discretionary money went to Project 3.63, and all of the oil and spills and LUST money goes to Project 3.62 (no S&T). Project 3.61 receives money from the Superfund Program. OLEM also kicks in money. Dr. Geller added that there is a matching funds program. Dr. Raffaele added that funds are also directed to specific projects such as the LEAF methods.

Dr. Cervero noted that, implicitly, the charge is focused on applied research informing practice and advancing technology. We wondered if the applied element should be the focus of the responses to the charge questions. On the site tours, the subcommittee saw research advancing knowledge. He asked if charge questions should address how well the research contributes to applied science versus basic science that helps other scientists do a better job at, for example, building better test equipment. Dr. Geller responded that the subcommittee should note in the responses to the charge questions if they feel limited in their ability to comment on the technical nature of some science. There is a balance of fundamental or foundational science and what feeds directly into technology and tools for application. In general, SHC has these two streams: scientists who produce knowledge and scientists who produce tools. Technical support centers provide a superb substrate for bringing together these two streams of science.

Dr. Flint asked the subcommittee to provide a deeper and a broader look at some of this science in their respective areas of expertise. The subcommittee provides a broad range of expertise.

Mr. Naud asked if ORD sets aside budget specifically for science related to emergency response and emerging or new issues. Dr. Geller replied that ORD programs handle this issue differently. Some programs sequester money for contingences as they might arise. SHC does not sequester money and disperses all of their money and are transparent about this process. When issues like Flint or Gold King mine occur, SHC works with the other ORD program offices to respond to these events. In general, ORD slows down efforts in other areas, such as climate change adaptation, so that those same experts (mainly with expertise in exposure modeling) can respond to emergency events.

Dr. Dannenberg asked SHC if their research on oil dispersants is proactive or reactive to the Deepwater Horizon event. Dr. Raffaele responded that some method development is in support of specific rules, such as Subpart J rule. There is sometimes increased pressure to complete certain activities, but the work on oil dispersants was proactive rather than reactive. Dr. Geller added that the NCP and the allowable solutions and compounds are well established in the National Response Team, of which EPA has been part, which was established as part of the Oil and Pollution Act in the 1990s. Dr. Dannenberg pointed out that this work could have been in response to the Exxon Valdez spill. One key facet of resilience is preparedness. The Homeland Security, SSWR, and ACE research programs do more work in this area.

Dr. Geller shared that one of the goals of ORD is to increase the public health message. ORD has worked with CDC in the past, but this work has increased more recently. He supported Dr. Rubin's comment about recognizing children living in vulnerable communities.

Dr. Flint reviewed the three charge questions:

> Charge Question 1: How well do SHC's research and development accomplishments and proposed research address high priority Agency, state, and community needs in this area?

Charge Question 2: How well does SHC's planned research anticipate future problems in this area and address longer-term community sustainability and environmental justice goals?

Charge Question 3: Do you see SHC's Sustainable Approaches for Contaminated Sites and Materials projects, and associated research from other parts of SHC, as helping communities achieve sustainability?

Dr. Flint asked the subcommittee to consider charge question 6 from last year's charge questions.

Dr. Flint proposed evaluating the needs, future, long-term community sustainability, and environmental justice for each of the three project areas. The subcommittee can then look at helping communities achieve sustainability overall rather than for each specific project area.

Dr. Cervero pointed out that the discussions are similar between Project 3.61 (contaminated sites) and Project 3.62 (oils and fuels) and there may be some redundancy. Mr. Kelly agreed that both projects are focused on addressing and investigating contaminants in the environment.

Dr. Rubin asked why the two projects are separated because the answer may provide insight on how they should be approached. Dr. Flint clarified that the two projects are separated because they have separate regulatory authorities, funding streams, and address different aspects of emergency response.

Dr. Raffaele added that there is also the aspect of prevention when dealing with oils and spills. Prevention is an important consideration. There are specific methodologies for evaluating dispersants, how likely tanks are to leak, and what gets released to the environment. There are unique issues and differences with respect to attenuation and this is a more prominent consideration within Project 3.62.

Dr. Rubin echoed Dr. Dannenberg's comment about differences within the two project areas with respect to prevention and emergencies.

Mr. Kelly noted that long-term response and short-term spill cleanup are also important considerations. Several points continue to be evaluated such as fate and transport and who is being exposed. Dr. Irwin added that the community impacts and timing could also be different, and differences with respect to space and time matter. She advocated for keeping the two projects separate.

Dr. Cervero stated that, from high-level view of the projects, there could be overlap with respect to policy informing guidance.

Dr. Flint asked the subcommittee to consider how each project is responding to these needs. The subcommittee should differentiate and show the commonalities between the project areas. Everyone should contribute and participate in the response to each charge question for each project area, but for efficiency, the subcommittee can drill deeper into some areas and have several writing teams.

The subcommittee broke out into three small groups to discuss the first two charge questions and brainstorm initial points. The subcommittee decided to reconvene to discuss charge question 3. The subcommittee was divided into the following groups:

- Project 3.63 Sustainable Materials Management participants: Dr. Tharakan, Dr. Dannenberg, Dr. Martín, and Mr. Steinhoff

- Project 3.61 Contaminated Sites participants: Dr. Irwin, Mr. Kelly, Dr. Rubin, Dr. Cervero, and Dr. BenDor
- Project 3.62 Oils and Fuels participants: Mr. Naud, Dr. Nance, Dr. Meyer, and Dr. Flint

Working Lunch
Subcommittee

The subcommittee broke out into three discussion groups, one for each project, to begin thinking about responding to charge questions 1 and 2.

Subcommittee Discussion and Writing
Subcommittee

Dr. Flint noted that Dr. BenDor was still participating in the meeting by phone and explained the process for responding to the subcommittee's charge questions. Although the subcommittee divided into three groups, one for each project with Project 3.61 and 3.62 having some overlap, the subcommittee would keep the projects separate for the time being.

Dr. Flint asked each group to present their findings in response to charge questions 1 and 2, and the rest of the subcommittee members would provide input on the points that they would like to be considered in the report. The subcommittee would then discuss charge question 3 with their remaining time and would put together a process for discussing that question after the meeting if need be. She added that there would be a group to address charge question 3 created at some point, and charge question 3 would likely emerge in the discussion of Project 3.62. After the meeting, the project groups would write up their charge question responses and the subcommittee would have another opportunity to review the responses and ensure that the report contained all the necessary topics. The final report would also be distributed to the subcommittee for consensus and any points with disagreement would be stricken from the document.

Mr. Cujé clarified that FACA allowed topics to be included that had majority agreement, even if there was some dissention. The subcommittee should be aware that they are free to work in groups of less than a quorum, but would trigger FACA if they work in larger groups. Dr. Flint further added that some points that may be valid, but do not reflect the subcommittee's thoughts as a whole, were generally stricken from the document.

Dr. Flint turned the discussion over to Dr. Irwin to discuss the responses to charge questions 1 and 2 for Project 3.61 on Contaminated Sites.

Dr. Irwin explained that the Project 3.61 group structured their discussion by using the subtopics from the last subcommittee report, which included general observations, particular strengths, and opportunities for improvement, challenges, and recommendations.

SHC 3.61, Charge Question 1: How well do SHC's research and development accomplishments and proposed research address high priority Agency, state, and community needs in this area?

Dr. Irwin read the group's general observations. The group thought that ORD had great research and was doing a good job of addressing vexing questions on the ground from a community and state perspective. There was evidence that ORD was responsive to communities and states but Dr. Irwin explained that it was difficult for the subcommittee to judge how evenly the research was distributed because they only reviewed a small portion of ORD's research.

Dr. Irwin explained the group's thoughts on Project 3.61 strengths. She began by echoing previous comments about ORD's outstanding science and high quality research. The PACT efforts were a great way for ORD to be even more responsive to program and other stakeholders in the future and the research roadmaps, including the Environmental Justice and Climate Change roadmaps, were a promising way to be more responsive to research needs in the future. Dr. Flint asked if the group's strengths were specific to Project 3.61. Dr. Irwin clarified that they were, and the group could include specific examples to better support their points.

Dr. Irwin explained the Project 3.61 opportunities for improvement. It was not clear how well ORD was addressing the needs of states and communities. Mr. Powell gave a description of that process but there did not appear to be a systematic process for the way needs are assessed (e.g., a survey for needs assessment) or for how project prioritization occurred. The group agreed that the research was still too siloed and there needed to be better integration across programs in order to be fully responsive to the research needs, particularly at the community level. ORD still seemed to struggle with going from the remediation piece to restoration or revitalization of the research. Dr. Irwin explained that, although much of the restoration research was taking place, it did not appear to be evenly occurring across program offices. She offered the example of the revitalization work happening within the Superfund and Brownfields Programs, and the social scientists they had available that other program didn't. Dr. Irwin added the caveat that some of these opportunities for improvement topics strayed over into charge question 2. She explained that the research was often focused on the health of people and ecosystems but the perspective should be broadened for a more holistic assessment of benefits and cost. She explained that a broader perspective was needed to account for the elements of social welfare, including the economic benefits (e.g., job creation), ecosystem services, and social impacts.

Dr. Irwin moved on to discuss the group's recognition of the many challenges posed to ORD, including their limited resources. There were also challenges of communication because SHC was removed from communication with on-the-ground communities by design. Additionally, the amount of science being produced resulted in knowledge overload, which posed communication challenges in terms of packing and structuring the knowledge so it is useful to communities and responsive to their needs. However, the subcommittee recognized that EPA had to rely on their partners to inform them of their community needs.

Dr. Irwin explained possible recommendations. The group was considering a recommendation that would focus on systematic needs assessment that would include input from various stakeholder groups (e.g., regions, communities, and contractors) to ask how the resources (e.g., funds, staff, and equipment) can best be allocated. The group recognized that ORD was operating in the context of resource limitations and scarcity and recommended strengthening partnerships with other agencies to better leverage resources within EPA and across federal agencies. For example, EPA and CDC could partner of issues related to health. The group recognized that, over time, there needed to be a rebalancing of expertise in ORD to include a broader range of scientists, such as social scientists. This would further the objective of including more revitalization efforts and help address broader wellbeing questions in future projects.

SHC 3.61, Charge Question 2: How well does SHC's planned research anticipate future problems in this area and address longer term community sustainability and environmental justice goals?

Dr. Irwin explained that the Research Roadmaps on Climate Change and Environmental Justice being developed are great tools for lining-up planned research with anticipated future problems. The group brainstormed what the anticipated future needs could include and came up with topics such as: the environmental changes that would come with climate change and the associated impacts; emerging and potential pollutants (e.g., algal blooms and the health effects associated with endocrine disruptors); the emerging technology changes that are transitioning us away from a hydrocarbon-based economy to renewable resources and the anticipated changes in environmental impacts, pollution, and resource savings that would inevitably come from that; and the implications of other mega-trends, such as globalization, migration, and changes in consumer preferences towards a shared economy (e.g., car economy). These future topics posed challenges for how ORD would organize itself to account for the most important future trends.

Dr. Irwin read the group's particular strengths, such as the site-specific research that incorporated broader neighborhood and community concerns and addressed future needs. For example, the projects on stakeholder involvement in prioritizing ecosystem services, particularly the Great Lakes areas of concern for community groups, were good models for including stakeholders.

Dr. Irwin moved to the opportunities for improvement and explained the need to connect the site-specific immediate ORD research to the broader environmental justice and sustainability goals like human wellbeing. She added that this point was captured by the diagram the group used from the previous SHC subcommittee report. The group also recognized the many challenges associated with achieving this connection. For example, dealing with contaminated sites is a backward-looking issue so looking forward to anticipate new and emerging contaminants is a challenge. The goal should be to switch the focus from remediation to prevention and anticipate future problems. Dr. Irwin explained that, although it was impossible to predict events like Flint Michigan, there were systemic factors underlying those types of events that could be better understood; ORD could conduct research to better inform and understand those factors to aid in preventing those types of events. The group underscored the challenge of communication and the need to communicate and understand the direction communities would like to go in if the goal is to achieve long-term environmental justice and sustainability issues. Dr. Irwin added that this was a bottom-up process, which is challenging for federal agencies like EPA.

The group recommended that EPA collaborate more with other agencies and ORD rebalance the mix of scientist expertise. The group also recommended focusing on the economics of sustainability to broaden the focus from remediation and containment to thinking about the impacts on humans and the value generated for individuals and communities where those activities took place. The group discussed an asset-based approach to thinking about the economics of sustainability. Communities have a broad set of assets, including financial, manufactured, social, natural, and human/education capital stocks. The economics of sustainability approach takes into account the valuation and management of those community assets as well as the impacts of various actions (e.g., pollution, degradation, environmental impacts) on those assets to measure the long-term goals of environmental justice and sustainability within communities. Dr. Irwin added that the definition of community sustainability is that their well-being is not declining over time so this asset-based approach could be a helpful analysis.

Full Subcommittee Observations and Discussion on Project 3.61

Dr. Flint began the subcommittee wide observations discussion by noting that the Project 3.61 group really delved into the charge questions and where the conversation goes when addressing charge questions about longer term community sustainability and environmental justice goals. She reminded subcommittee members to focus on SHC's real project science that focused on providing the tools for contaminated sites and the technical support for scientific issues, including research on vapor intrusion, contaminated sediments, and contaminated groundwater. It was important to recognize what the SHC science was about to ensure that the subcommittee used examples of their work and made appropriate recommendations. Mr. Kelly clarified that the group intended to pull specific examples from the posters and the work that they saw during the meeting that the group thought of value to highlight.

Dr. Flint thought using specific examples was a great idea. She recognized that it was easy to go beyond the scope of the science when talking about long-term sustainability issues and environmental justice goals. However, it was important to differentiate between the science piece and the focus of charge questions so that the subcommittee could provide the SHC scientists with an evaluative report that provided relevant and useful feedback. She then asked the subcommittee members if there were any additional topics that they would like to include in the responses to charge questions 1 and 2 under the Contaminated Sites Project.

Dr. Dannenberg mentioned that Stan Meiburg was an EPA staff member on assignment at the CDC National Center for Environmental Health and it was a great partnership that provided an easier avenue for communication. Dr. Flint asked if that was part of Project 3.61 and Dr. Dannenberg clarified that the group had a recommendation to partner with other federal agencies so he wanted to make the subcommittee was aware of that partnership. Dr. Meyer added that was a relatively recent experience that began about 5 years ago.

Dr. Meyer added the caveat that he was not sure if ORD or someone else was responsible for conducting the community research, but the application for brownfield grants was a really rich source of information about community needs. He explained the kinds of information that could be extracted from those applications, including the things that communities were asking for money to do, which could provide information regarding the things that communities want or need and the things that they don't understand or are misinformed about. The ORD laboratories had collected data for topics that may not traditionally be considered laboratory science, such as the disposition of electronic waste, so an effort to compile brownfields grant information to better understand and address community needs is not totally beyond ORD's purview and could be an interesting topic to explore.

Dr. Martín noted Mr. Powell's comments about specific federal agencies that were doing related work, such as Department of Energy and the National Institutes of Health, and suggested the subcommittee name them in their report. He also asked if the group reviewed Mr. Powell's research list of priorities and agreed with those research needs, including defining large sites, complexity, and site characterization. Dr. Irwin responded that the group agreed with SHC's high priority research needs but wasn't sure how they came up with those topics.

Dr. Meyer explained that the Office of Sustainable Communities was where many liaisons with HUD, Department of Defense, and other federal agencies occurred and suggested the

subcommittee mention that in their report. He added that the partnerships could potentially fall under charge question 3. Dr. Flint noted that she thought the Office of Sustainable Communities was mentioned at the beginning of the subcommittee meeting, and Ms. McCullough drafted that charge question.

Dr. Geller brought the subcommittee's attention back to their recommendation on communicating the science and the vast amount of it and noted the demonstration of the materials management wizard and the eco health browser, which are some of SHC's efforts and innovative ways to communicate science. He asked the subcommittee to include in their report if they saw these tools as a way to communication the breath of technical information. He further asked the subcommittee if they saw these tools as a way to focus what is needed and to whom at the appropriate technical level with the understanding that the tools were a technical fix and human communication was often needed, which was a big challenge in terms of resources (e.g., capacity and time).

Dr. Flint noted that there were sections in the text provided to the subcommittee on collaborations. For example, page twelve under Project 3.61 included a lengthy, itemized list of the SHC partnerships with other ORD programs, within EPA, and external partnerships at the national and international level and the tasks also included relevant partnerships. She suggested that these could provide the substance included in the bullet points under the observation of good ORD partnerships or could be a counter point if the subcommittee recommended more collaboration is needed at SHC.

Dr. Cervero clarified that the municipal utility districts were likely running community meetings to obtain citizen and stakeholder input. There had been significant focus on horizontal channels of communication (i.e., cross-federal agency communication) but, if the goal was to link the federal entity with the grassroots level of communication with community organizations and non-governmental organizations to address their issues (e.g., water quality), then developing existing and new vertical communication channels with districts, states, and communities should be the focus. He suggested packaging information for specific communication channels, such as with states, municipal utilities, cities, and improving those vertical communication channels in order to address higher level issues like environmental justice. Dr. Flint noted that the EPA regions play that role but Dr. Cervero noted that this communication during municipal utility public outreach efforts would still be helpful for communicating important information at the grassroots level.

Mr. Naud explained the model where EPA Region 1 supports an Urban Sustainability Directors Network regional network of cities. He added that there were also regional networks, in addition to city networks, and suggested using the Region 1 as a model for possibly aligning the existing networks with the ten EPA regions so EPA could have easier access to the municipalities and community needs at the city level. Dr. Martín asked if what Mr. Naud was describing was like the sustainable knowledge corridor but Mr. Naud explained that it was different; the USDN was a northeast network that Region 1 helped coordinate for them and, in return, received insight into projects beyond ORD's efforts that were happening in cities. Dr. Rubin suggested using Pediatric Environmental Health Specialty Units, which focuses on children's environmental health in particular, as a great resource for connecting with communities and identifying areas of concern.

Dr. Tharakan noted that a lot of great science was being done but explained the project outputs and proposed outputs don't provide tools to address community needs. He suggested that these communications be extended to Town Halls so the community was aware of the problems and how they were being addressed. The main focus of Project 3.61 was backwards in nature because it was solving historical problems, and no one was aware of the work ORD was already doing to address those problems. Dr. Tharakan suggested the focus shift in the future to more preventative efforts and industries should be more aware of not creating contaminated sites or waste streams that need to be dealt.

Dr. Nance agreed that more engagement with local communities was needed. SHC should create metrics, such as collaboration, for themselves to assess that engagement. EPA should be more visible on-the-ground to communities in positive ways, and ways to translate research results in local communities was needed. She added that she was impressed with the science but this other piece was so lacking and a broader range of scientists was needed to achieve those objectives. Dr. Flint noted the challenge of talking about the specific scientific topics that ORD addressed (e.g., contaminant concentrations in sediment and fish tissues and the transport in aquifers) that have human health and ecosystem implications that are relevant to communities. She explained that it may not be useful to send bench scientists to Town Hall meetings to explain the issues and how they are being addressed. The communication obstacles become a resource and staffing issue. Dr. Cervero disagreed and explained that bench scientists could be a type of resource and provide an opportunity for two-way learning at the neighborhood level.

Dr. Flint suggested including the strong linkages between Task 1 and Task 5 in the report. Task 1 was focused on lessons learned through the technical support. Task 5 was focused on the tools for evaluating the spatial and temporal impacts of contaminated sites (e.g., DASEES model) and the tracking mechanisms, which included more meta-analytical and database building objectives that were coming out of ORD's actions in local communities. Linking these tasks could allow for lessons learned to be documented and evaluated over time. Work under Task 5 could inform Task 1 work by synthesizing the lessons learned within the technical support realm.

Dr. Flint asked if the subcommittee had any additional points they would like to capture. Hearing none, she added that the notes were captured and would be distributed to the subcommittee before moving on to Project 3.62 on Environmental Releases of Oils and Fuels.

SHC 3.62, Charge Question 1: How well do SHC's research and development accomplishments and proposed research address high priority Agency, state, and community needs in this area?

Dr. Flint explained that her group did not think too much about how Project 3.62 connected to the contaminated sites work and went right into the details of responding to charge questions 1 and 2. Her group started their discussion with the five posters and worked from the details to the charge questions. She reviewed the research topics under Project 3.62. She explained the fate and transport as dispersion issues related to oils research topic, which included: the wavelength work and hypersaline conditions; the sensor development, mapping of oil transport, and related issues; and the evaluation of the products on the NCP (i.e., examining the effectiveness and toxicity of those dispersants for use in oil spills. Underground storage tanks were another research topic, which included vapor intrusion issues, the mapping of private wells, and the model of vapor instruction as a tool for use.

The group then went back to their notes to determine if the projects were meeting the research needs and concluded that, in general, ORD was responsive to research needs and were providing key tools and information. The research topics themselves emerged from deliberation with the partners and ORD had focused their research to meet those priorities, so there appeared to be good synergy especially at the agency level. There also appeared to be good technical assistance and information provided to meet the needs of first responders, some of which are within EPA, so the group captured those successful partnerships and efforts as well. Dr. Flint noted the group could not find where the regions were involved in this process until they noticed that the regions were comfortable with Mr. Foster representing them at the meeting. She explained that the group thought this spoke volumes about the positive partnership between ORD and the regions. Beyond EPA, ORD was also partnering with NOAA, the Department of the Interior, and Canada and EPA recently had a conversation with states about elaborating priorities that will become an annual partnership; the subcommittee planned to commend all these positive partnerships in their report. Dr. Flint asked if the state collaboration effort was on the oil or tank side of ORD's projects and Dr. Raffaele clarified that those partnerships were on underground storage tank projects.

Dr. Flint explained that, in terms of oil issues, states were often part of a suite of responders that needed information from ORD to make decisions in the field. The underground storage tanks area was where states seemed to be predominant. The group liked ORD's recognition of the variation between states and the understanding that states had different priorities but noted the data issue regarding underground storage tanks. Dr. Flint explained that relationships with states were critical in order to overcome those data challenges (e.g., identify where private wells are located and determine where there was a backlog is) because states had the data necessary to address those issues.

The group recognized the responsiveness to community needs regarding local spills, including ORD's responsiveness to the information on the dispersants and what is happening with the oil needed by the first responders. However, more communication to communities is needed so communities are aware of what is happening, why the remediation method was chosen, and the implications of those remediation methods, especially with regard to oil dispersants that can have human health and ecosystem implications. Dr. Flint added that information on oil spills and cleanup effort methods are critically important issues to communities so communication of the hazards faced by communities was important and there may be best management practices and feedback with those responders needed there. Dr. Flint summarized that the group thought communication between EPA and states was quite good and communication with states and communities was important, even if it was not necessarily within the scope of the science.

SHC 3.62, Charge Question 2: How well does SHC's planned research anticipate future problems in this area and address longer term community sustainability and environmental justice goals?

Dr. Flint explained that the group was happy to see SHC's research addressing climate change issues. For example, SHC had oil research that considered the effects of changes in water salinity on oil dispersant and underground storage tanks research that considered water table issues, such as aquifer changes and groundwater depletion issues that could be a result of climate change or changes in demand.

The group recognized the work on different kinds of fuels but suggested that SHC consider changes in the different kinds of energy and fuels used in the future due to changing industry, technology, and demand and anticipate how those changes could affect the geographical (e.g., water and land) context of oil spills. For example, changes in how and where oil is being used and transported should be considered when anticipating where oil spills might occur in the future.

For long-term community sustainability, the group discussed restoration and recovery of leaking underground storage tanks as a long-term sustainability issue but recognized that the Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act (RESTORE Act) came into play, and they were unsure if that was a responsibility of SHC scientists. Dr. Flint explained that the group recognized that oil and first responder needs are more short-term in nature but the effects of using dispersants is a long-term community sustainability issue. She suggested that SHC think more about research characterizing dispersant toxicity and its long-term implications as a long-term community sustainability issue instead of only looking at the dispersant effectiveness.

Dr. Flint explained that environmental justice goals were not explicit but implicit in all of SHC's research and depended on where the oil spills and leaking underground storage tanks occurred. The group noted that overburden communities may be more vulnerable to oil spills and those social and health vulnerabilities should be considered in SHC's research. For example, an overburdened community might be affected by additional toxicity issues from other exposures or might not have the same capacity as other communities for a local response. She explained that, if their characterization of the population that was exposed is an underserved, overburdened community, then it could be an environmental justice issue.

Full Subcommittee Observations and Discussion on Project 3.62

Dr. Tharakan asked whether fracking was included in SHC research or if there was a separate EPA research effort that dealt with it. Dr. Geller explained that fracking was under SSWR and ACE's purview. In addition, the National Center for Environmental Research (NCER) put out grants for unconventional oil and gas (i.e., fracking) under the National Priority funding. Dr. Meyer agreed that fracking should be included in the subcommittee's report under anticipated future problems because it could change the geography of oil transportation. For example, it may add reliance on more trucking or new pipelines that may have otherwise occurred, which can feed into potential environmental justice impacts. However, Dr. Meyer was not sure how fracking research (e.g., where the spills are and what are the potential sources of those spills) would fit into SHC's research agenda. Dr. Cervero agreed that the geography of contaminants was an interesting topic, and it was great that the climate research was considering that topic. He asked if the United States was moving away from lineal distribution systems like pipelines, given the move from hydrocarbons to renewables. He added that mapping out the geographically of the distributional consequences of fracking was important for environmental justice issues and the geography of contaminants tied back into feedstock energy. Dr. Meyer confirmed that the United States was transitioning away from oils and he anticipated declining problems from that transition but noted there would still be legacy issues. Dr. Cervero clarified that the point he was making about pipelines was that contamination could be targeted but energy that was distributed

and itemized became a much more complex landscape to target geographic efforts; the concentration of geographic distribution could be fundamentally different.

Dr. Rubin noted the possibility of more catastrophic oil spills and the environmental impact as well as the challenge posed to environmental justice communities that need to relocate but don't have the resources to do so. Dr. Flint agreed that it was critical to connect laboratory scientists to the impacts of these issues to communities in terms of overall well-being. She explained that many of those questions were related to social science and human and it was a challenge to see where the science fit into society. Dr. Geller explained that the UST project has an everyday impact on environmental justice issues. Dr. Weaver and Dr. Kremer were looking at vulnerability based on density of underground storage tanks. They worked out some techniques to evaluate the density of private drinking water wells, which began the process of piecing together the data need to do the analysis. Dr. Geller knew that there were some publications examining environmental justice issues, like Dr. Wilson's analyses around the South Carolina ports looking at the demographics of populations affected by leaking UST, but he was unsure if it was a national literature and asked if OLEM had done environmental justice analysis on projects like the UST project. He added that SHC was engaged in the technology and technical expertise (e.g., whether the fuel composition elements lead to corrosion) of UST to prevent leaks but conducting research and working with partners to do more environmental justice analysis was something SHC could consider.

Dr. Raffaele explained OLEM's work related to identifying where USTs were in relation to aquifers, which considered changes in flows and depths from climate change and how that could impact LUST remediation. OLEM was also considering which centers to focus their research on that might be located in more vulnerable communities. There was also an effort to identify revitalization uses for sites, such as putting a clinic on a site that the community needs, which also addressed some environmental justice issues.

Dr. Taylor explained some of the work Dr. Kremer did on groundwater flow changes when new wells were installed, but Dr. Flint noted that work was not in the subcommittee's materials before turning the subcommittee's attention back to the discussion on Project 3.62.

Mr. Naud noted the discussion about evaluating carbon injects and the 78,000 backlogged sites for *in-situ* cleanup and asked what technology SHC was developing that would be relevant for *in-situ* cleanup methods at the city level. Dr. Geller explained the issue of crossover into other infrastructure, particularly how fuel composition that can lead to the breakdown of gaskets, which is going to affect the utility structure outside of petroleum handling infrastructure. This could be a crosscutting issue across the report. Dr. Dannenberg mentioned another crosscutting issue of staff retirement and getting new staff into EPA and asked if the subcommittee would like to include that recommendation here. Dr. Flint clarified that if the recommendation related to the charge questions of meeting needs and addressing future problems, then the recommendation should be included. Subcommittee members agreed that retirements are an overarching issue, and Dr. Dannenberg clarified that the recommendation would be for ORD to pay attention to the retirements and ensuring continuity. Dr. Cervero added that the effort would also enlarge the knowledge base and suggested bringing in geographers who specialize in models that differ in resolution and scale. Dr. Meyer suggested considering extreme weather events from climate change as another anticipated future need, especially in terms of UST. Dr. Flint asked if the

subcommittee saw anything in their provided materials about extreme weather events. Dr. Tharakan thought the text mentioned extreme weather events, and Dr. Flint agreed that the subcommittee should look for it when they write up the report. She then turned the meeting over to Mr. Steinhoff to present his group's discussion of Project 3.63 on SMM.

> *SHC 3.63, Charge Question 1: How well do SHC's research and development accomplishments and proposed research address high priority Agency, state, and community needs in this area?*

Mr. Steinhoff explained that, in terms of meeting agency needs, there was evidence of improvements in communication and responsiveness as a result of the research agenda consolidation, which could also be a mechanism for more cross-collaboration ideas and communication of needs to the right people. The PACTs were a step in right direction for creating more connections, but Mr. Steinhoff suggested that SHC consider a more formalized process for achieving their goals. The group's recommendation was to create more opportunity or reinforce current opportunities for regional details and ensure that ideas were flowing between all parts of EPA.

Mr. Steinhoff explained that many state and community needs came from EPA programs and regions so it is important for ORD to have conversations with regions and programs to ensure that their goals were being met, which appeared to be happening more. The need for detailed data on events and available materials for material management so as to make better decisions was a gap identified when examining the posters. There were examples of projects that developed high quality datasets to address Agency and state needs but the group didn't see efforts to scale down those tools for the community or decision-maker level.

> *SHC 3.63, Charge Question 2: How well does SHC's planned research anticipate future problems in this area and address longer term community sustainability and environmental justice goals?*

Mr. Steinhoff explained the group's recommendation to make environmental justice more explicit going forward. Work with LCA was good for thinking about the big picture of environmental justice issues but it potentially missed or misinformed placed-based decisions so the group recommended that SHC think about how those decision-maker tools could be tailored for place-based decisions. The group thought the ability of the health model and the storm management model to adjust to potential impacts from climate change was great and reflected EPA's efforts to integrate research. However, the group suggested that this be more explicit for material management. For example, tools that look at the use of organics and how that changes moisture conditions should be developed. In general, the group suggested more landscaping investigations; instead of focusing on existing connections, SHC should bridge the gap between EPA research, communities, and states to build more awareness of emerging needs.

Full Subcommittee Observations and Discussion on Project 3.63

Dr. Martín suggested SHC use policy, the EPA programs, and EPA regions to reach out to the environmental justice offices and International Traders Office (ITA) to do a better job of determining what future community needs are, specifically from a program and policy side. He also suggested SHC work with offices with grant mechanisms, like environmental justice and

brownfields, to see how the grantees were using their grant money and connect the environmental justice offices with communities directly.

Mr. Naud explained that there was an assumption that cities were taken care of by the states but that wasn't true and Flint, Michigan was an example of that. Solid waste innovation was happening at the city level and he explained how that was an opportunity to ask the city about their research needs. He explained how states were not driving research into bio-digesters and EPA regulated what goes into landfills but not the process of putting it there so the solid waste space was an opportunity for EPA to ask the community to identify their needs. Mr. Steinhoff added that this point echoed the point about the landscape and missing communication links between various levels of regulatory bodies.

Mr. Steinhoff suggested that there was opportunity to do more research around the effort to divert waste materials and find different uses for them. For example, finding different uses for municipal waste or coal ash was important to many of states. Closing that cycle and creating a demand for waste materials was important but the subcommittee recognized the challenges associated with doing that, including working with industry. Dr. Flint recognized the entrepreneurial piece required for waste reuse and the required communication throughout the EPA and out to industry, municipalities, and stakeholders. It was also important to understand how electronic waste varied under different circumstances. For example, waste collection programs needed to consider collection locations and timing as well as landfill conditions, such as substrata and climate, to determine how waste could be reused. This concept was reflected in the LEAF model that considered emissions issues with shifts in inorganics to organics. Dr. Flint asked if the health model was incorporating all the different contextual effects of landfills. She added that it was difficult to work with industries because they didn't need to provide specific information on considerations such as their products and processes. Dr. Irwin added that cost of different materials was another context-specific aspect that was starting to be incorporated into some lifecycle models. Dr. Dannenberg noted that EPA could ask industry to do the survey and EPA could provide technical assistance but Dr. Flint noted that comparability lacked if different entities were doing surveys differently.

Dr. Flint noted the great collaboration effort with SHC and membrane companies regarding solvents but was not sure if that fell in agency, state, or community needs. Dr. Geller clarified that the materials recovery circular was the effort to reduce waste. Mr. Naud explained that the WARM model was really helpful at the community level and helped him as he talked to investors about the uses of different materials, specifically when the model informed the city that landfills were not an efficient source of methane gas. Dr. Meyer noted that electronic waste was potentially valuable material so recovery more of it could be advantageous. He added that putting out recycling bins was enough to change community behavior so an effort to see what else can be down at the household and industry level to collect more electronic waste would be helpful.

Dr. Meyer noted that another area of waste management could be the collection of demolition debris for reuse and he explained the example in Cincinnati, Ohio where industry gave this debris to people rehabbing homes. Dr. Taylor explained that ORD already had a study looking at construction demolition debris and the report was already in draft form. Information on that study was provided in the subcommittee materials in Project 3.63 under beneficial use.

Dr. Rubin noted three projects that struck him for this project. The first was the risk module that anticipated future issues, which Dr. Rubin found to be forward thinking. The second project was the one examining wood reuse after Hurricane Katrina that convinced the surrounding community how to use wood in various ways and the third project was the net zero project. Dr. Rubin added that he thought all three projects were excellent examples of materials management. Dr. Meyer added that the net zero project built connections with communities that could provide an avenue for other kinds of projects, such as testing electronic recycling methods. Dr. Rubin noted that the net zero organizational structure was borrowed from the military so thought about how to transition that into a democratic, free-range society would be needed for broader applications.

Dr. Irwin explained that the RIMM tool struck her as being incredibly useful for communities and other local organizations because it was a spatially explicit tool that combined numerous layers (e.g., fate and transport, outcome, and impacts) into one model. Dr. Flint noted the work done on lifecycle analysis often included environmental benefits but should also include the social components of sustainability, such as labor justice, workers, fair practices, and corruption. She added that environmental justice issues had to be included in lifecycle decisions about sustainable waste management. Dr. Irwin suggested that the workgroup talk about the work on integrated LCA and ecosystem services when making this point in their report.

Mr. Kelly noted that he was also impressed with the tool on reusing wood from Hurricane Sandy tree waste. Those simple analysis tools were valuable and useful in a variety of situations, including disaster response and site cleanup) and he suggested they be made more available.

Charge Question 3: Do you see SHC's Sustainable Approaches for Contaminated Sites and Materials projects, and associated research from other parts of SHC, as helping communities achieve sustainability?

Dr. Irwin noted that charge question 3 came out of charge question 6 of last year. She presented a schematic the subcommittee developed last year that outlined how to go from short-term remediation to longer-term sustainability and environmental justice goals. Spatial and temporal dimensions were represented in the figure and she explained that the thinking was site-specific management was a short-term consideration while sustainability and environmental justice were more long-term. Dr. Irwin explained the figure moving from left to right. The left began with site, followed by neighborhoods and community. The figure included community outcomes that represented environmental justice and sustainable community components, such as health outcomes, economic impacts, well-being, social equity, and ecosystem services. Dr. Irwin explained that the challenge was to link short-term site-specific things to the broader long-term community considerations. She explained that the middle of the figure (i.e., neighborhood) focused on translation from sites to community (e.g., identifies areas of concern). The idea was that the neighborhood level was needed to go from the site to community level; this connection was needed to determine the best long-term site use based on community and site factors. She added that all of these decisions were informed by institutions that influenced all the levels and private, state, federal, and other entities could fill that role. Dr. Irwin added that community outcomes could be thought of as indicators for measuring environmental justice and community sustainability.

Dr. Flint explained that there was a lot of system-based management and a broader community context but asked what evidence the subcommittee saw in their materials that suggested these shifts were being considered and enabled. Dr. Geller added that the subcommittee might have scarce information in this area. He explained that one reason SHC was interested in expanding their partnership with the GLNPO was because of their flexibility and added that brownfields were a great place to work with GLNPO. There were EPA projects that begin to think more about ecosystem metrics and evaluation in terms of assessments for values and actions that can be taken. The RARE projects that Ms. Lynch and Ms. Cutt presented were examples of the best places to do site-based and neighborhood and community-based work. Dr. Geller added that the site-based work had been facilitated by the regions and their community partnerships. He noted that it would be helpful if the subcommittee continued to work on the framework because it would be a way to communicate these long-term objectives with ORD scientists.

Dr. Flint explained that the subcommittee needed to think about SHC as a whole to answer charge question 3 because work on indicators for environmental justice and community sustainability was done in SHC but not under Topic 3. She suggested members look at the SHC diagram explaining how SHC thought they were addressing community sustainability before making a first attempt at answering charge question 3.

Dr. Flint suggested the subcommittee take the next 15 minutes to make more general observations on Topic 3 as a whole. Dr. Martín agreed that the RARE projects were site-specific and considered community outcomes but noted the replicability issue with them. He suggested that the subcommittee should be provided more information on the research project outputs and the performance measures for those outputs. He explained that the PACTs thought about long-term evaluation of outcomes, which was great and should be occurring. However, Dr. Martín recognized that it was not fair to overburden SHC and ORD with that assessment. He challenged the greater community to do it, noting that the next step was to move toward external evaluations of research project outcomes used in the community.

Dr. Rubin noted two posters that he thought were examples of results the subcommittee would like to see from ORD's projects. The first was the project evaluating and understanding ecosystem services that really looked at revitalizing two areas with contamination. The first area was Dobby Creek, which had PAH contamination, and the second area was a mountain resort contaminated with lead and had a low pH. He explained that the project looked at remediation and restoring the ecosystems with particular site functions, utility, and recreational use in mind in addition to the remediation efforts. The second poster was on remediation, restoration, and revitalization. Dr. Rubin explained that, although the second project struggled with evaluating revitalization, some revitalization took place and had active community participation. He emphasized that he thought the two projects should be used as examples of what the subcommittee would like to see from ORD.

Dr. Flint explained the importance of considering certain topics in the site-based science conducted under Topic 3 to understand the broader implications and the long-term effects on environmental justice and community sustainability from the potential applications. When outcomes are included in systems-based research, and that research produces contextual effects, then that might begin to suggest that there are site-based components to the systems-based research. However, Dr. Flint added that the site-based component of systems-based research was

a bigger stretch then seeing systems-based work within site-based work; although, site-based projects often warrant the consideration of dealing with site-specific work within system-based research.

Dr. Tharakan noted that the posters took EPA all the way to revitalization, which was easier to do with site-specific work because the context was already defined. However, he noted that he would like to see the general science, such as developing risk management tools, transform from outcomes to measurable outcomes but that translation could only happen if SHC expanded their partnerships to industry or educational institutions. Dr. Tharakan reiterated Dr. Taylor's comment about the challenges of getting users, such as highway workers, to use the tools ORD developed for them because they were never taught how to use them early on in their careers. Dr. Tharakan suggested including tools in university curriculums because it would expand the knowledge base and capacity, which would allow these transformative changes to take place. Dr. Rubin noted that the SHC research was different than what the subcommittee was discussing. He explained that SHC research looked at real outcomes and impacts to communities and a different kind of research, partnerships, and scientists would be needed to introduce the social sciences. He noted that the impact on community health and wellbeing needed to be looked at but added the caveat that his suggestion might not be ORD's domain and he did not want to take away from the great science ORD was doing.

Mr. Steinhoff noted that something like the DASEES process was powerful and effective and, in terms of capacity building, he suggested training practitioners and others to use the tool so they know more about the decision science. Dr. Tharakan added that PACTs at the federal agency level would be helpful because federal agencies were tackling overlapping problems but the transfer of knowledge was still lacking and was an area for improvement. Dr. Flint suggested bringing Dr. Tharakan's point to the BOSC Executive Committee because it is not specific to SHC.

Dr. Meyer noted that the issue with DASEES and a number of EPA products with cleanup utility was the fact that people at the neighborhood and community level did not have the capacity to use the tools. He suggested EPA develop or adapt existing tools to be used by decision makers at those levels. Dr. Geller explained that part of the science development task was to develop tools that could be reasonably used at the neighborhood and community levels. The DASEES tool was revolutionary in that the SHC tool was able to convince OLEM to consider alternative approaches to their Superfund procedures. Dr. Geller explained that the DASEES application the subcommittee saw was a case study and the next step was to get the tool out there and build capacity in communities, which would be a challenge moving forward.

Dr. Flint asked Dr. BenDor if he had anything to add but he did not. She then asked Mr. Steinhoff to take the lead on writing up the draft charge question responses for the Project 3.63 discussions, Dr. Irwin to write up 3.61, and noted that she would write-up 3.62. Dr. Flint explained that the subcommittee would receive summary notes from these discussions that would help with their response write-up to charge questions 1 and 2. She was not yet sure how the subcommittee was going to approach their response to charge question 3 but asked Dr. Meyer to take the lead on that draft. She added that the charge question draft responses should be sent to the Mr. Cujé, Dr. Richardson, and herself. The report had to be finalized and sent to the BOSC

Executive Committee by December 23, but she, Dr. Richardson, and Mr. Cujé would discuss the timeline and communicate it to the subcommittee.

Dr. Rubin mentioned the diagram on one of Ms. Lynch's presentation slides that captured the momentum nicely and suggested that it could serve as a nice model. He asked if that was something the subcommittee could have and added that work related to SHC's work in Topic 3 about community engagement and successful partnership around remediating contaminated sites. Dr. Flint asked how this figure related to SHC's research under Topic 3, and Dr. Rubin clarified that the figure was about community engagement and the participation around successful partnerships in response to contaminated sites, so it fell under the subcommittee's scope. Dr. Geller added that a table provided in the subcommittee's materials expanded on the posters. The table included the successful ORD partnerships with the regions and OLEM and how those partnerships helped solve problems. He added that there was a partnership table for both Project 3.61 and 3.63.

Mr. Cujé explained that there was no specific format structure for the subcommittee's report but the recommendations should be clearly identified. He reminded members to send their draft responses to the SHC subcommittee chairs with him copied to the email. He clarified that groups were allowed to work together and send materials to each other but could not send their materials to the entire subcommittee. Dr. Flint added that the final report will contain the same numeric structure for recommendations but the first draft of responses only needed to pull out the recommendations.

Wrap-up and Adjourn
Courtney Flint, Vice-Chair; Jace Cujé, DFO

Mr. Cujé thanked the subcommittee for their participation and for the remaining members for their continued participation that allowed the subcommittee to meet quorum and continue the meeting.

Dr. Flint thanked the subcommittee for a great meeting, in particular the new member Mr. Kelly for getting involved in the SHC subcommittee. She concluded the meeting by thanking the members in advanced for pulling the report together.

The meeting was adjourned at 1:30 p.m., Eastern.

Respectfully Submitted:

/Signed/
_____
Mr. Jace S. Cujé
BOSC SHC Subcommittee DFO

Certified as Accurate:

/Signed/
_____
Dr. Robert Richardson
BOSC SHC Subcommittee Chair

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Appendix A: Agenda

Board of Scientific Counselors, Sustainable and Healthy Communities (SHC) Subcommittee Meeting: Focus on SHC Theme 3: Sustainable Approaches for Contaminated Sites and Material Management

November 2-4, 2016 in Cincinnati, OH
EPA's Andrew W. Breidenbach Environmental Research Center (AWBERC)
26 W. Martin Luther King Dr.
Adobe Connect for Viewing and Listening Remotely:
http://epawebconferencing.acms.com/shcteam
Conference Call for Presenters: 1-866-299-3188 Code: 202-564-3324#

Wednesday, Nov 2*	**Meeting Location: AWBERC Rms. 130-138**	**Presenter**
12:00 – 12:30 p.m.	Registration in AWBERC Rms. 130-138	
12:30 – 12:50	Welcome and Introductions of BOSC Members and Program Office/Regional Office (PO/RO) Visitors	Robert Richardson (SHC Subcommittee Chair) Andrew Geller (SHC Acting National Program Director)
12:50 – 12:55	Designated Federal Officer (DFO) Welcome	Jace Cujé (DFO)
12:55 – 1:00	SHC Welcome	Andrew Geller
1:00 – 1:10	Review of Charge Questions	Robert Richardson
1:10 – 1:20	Public Comments	TBD
1:20 – 1:30	Research Prioritization Process	Kathleen Raffaele, OLEM Diana Cutt, Region 2/ORD
Project 3.62: Environmental Releases of Oils and Fuels		
1:30 – 1:40	Program and Regional Office Overview of Research Needs: • What are your office's highest research priorities in regard to environmental releases of oils and fuels and underground storage tanks? • (optional, additional question) How do you differentiate what research priorities you share with ORD vs request from others (contractors)?	Stiven Foster, OLEM

	Goal: Speakers to help BOSC and other attendees understand pressing issues from a PO/RO perspective and how research connects to these.	
1:40 – 2:00	Successful Partnerships: • What are one or two examples of how ORD research or support assisted your program on oil and fuel related issues? *Goal: Build a narrative illustrating ORD interaction with other parts of Agency*	Carolyn Hoskinson, OLEM (via phone) John Cardarelli, OLEM
2.00 – 2:15	SHC Overview: Overall goal of project and orient attendees toward the individual tasks, preview highlights of the project and future directions. Presentation may include a match-up between OLEM/Regional priorities and ongoing or proposed research.	Robyn Conmy, Project Lead for 3.62 Jim Weaver, Deputy Project Lead for 3.62
2:15 – 2:20	Break	
2:20 – 3:00	Poster Session	SHC Principal Investigators and Subcommittee
3:00 – 3:20	Partner Panel Discussion: Panelists provide feedback on research process, research provided, and Agency needs. BOSC asks questions.	Will Anderson, OLEM (via phone) Stiven Foster, OLEM John Cardarelli, OLEM
3:20 – 3:40	BOSC Discussion: BOSC to share observations on posters, presentations, and partners panel discussions.	Subcommittee
3:40 – 4:45	Visit ORD Labs in AWBERC	Cindy Sonich-Mullin, ORD Subcommittee
4:45 – 5:20	Travel to Center Hill Facility	Subcommittee
5:35 – 6:15	Tour Center Hill Facility	Subcommittee
6:20 – 6:40	Return to AWBERC via bus & Wrap-up and Adjourn**	Subcommittee Robert Richardson and Jace Cujé

Thursday, Nov 3*	**Meeting Location: AWBERC Rms. 130-138**

Project 3.63: Sustainable Materials Management (SMM)		
8:30 – 8:35 a.m.	Opening	Robert Richardson
8:35 – 8:45	Program and Regional Office Overview of Research Needs: • What are your office's highest research priorities in regard to managing materials sustainably? • (optional, additional question) How do you differentiate what research priorities you share with ORD vs request from others (contractors)? *Goal: Speakers to help BOSC and other attendees understand pressing issues from a PO/RO perspective and how research connects to these.*	Tim Taylor, OLEM
8:45 – 9:05	Successful Partnerships: • What are one or two examples of how ORD research or support assisted in issues related to managing materials sustainably? *Goal: Build a narrative illustrating ORD interaction with other parts of Agency*	Nickie DiForte, Region 2 (via phone) Tim Taylor, OLEM
9:05 – 9:20	SHC Overview: ORD to present overall goal of project and orient attendees toward the individual tasks, preview highlights of the project and future directions. Presentation may include a match-up between OLEM/Regional priorities and ongoing or proposed research.	Thabet Tolaymat, Project Lead for 3.63
9:20 – 9:30	Break	
9:30 – 10:45	Poster Session	SHC Principal Investigators and Subcommittee
10:45 – 11:00	Tool Demonstration: MWiz (Materials Management Wizard)	Mike Nye
11:00 – 11:30	Partner Panel Discussion: Panelists provide feedback on research process, research provided, and Agency needs. BOSC asks questions.	Liz Resek, OLEM (via phone) Tim Taylor, OLEM Nicole DiForte, Region 2 (via phone)

		Ann Carroll, OLEM (via phone)
11:30 a.m. – 12:00 p.m.	BOSC Discussion: BOSC to share observations on posters, presentations, and partners panel discussions.	Subcommittee
12:00 – 1:00	Break / Lunch	
1:00 – 1:20	RIMM (Risk-Informed Materials Management) demonstration	Justin Babendreier
1:20 – 1:40	WARM-LCA (Waste Reduction Model - Life Cycle Analysis) Demonstration	Wesley Ingwersen
1:40 – 1:50	Break	
Project 3.61: Contaminated Sites		
1:50 – 2:00 p.m.	Program and Regional Office Overview of Research Needs: • What are your office's highest research priorities in regard to contaminated sites? • (optional, additional question) How do you differentiate what research priorities you share with ORD vs request from others (contractors)? *Goal: Speakers to help BOSC and other attendees understand pressing issues from a PO/RO perspective and how research connects to these.*	Dan Powell, OLEM
2:00 – 2:20	Successful Partnerships: • What are one or two examples of how ORD research or support assisted in issues related to contaminated sites? *Goal: Build a narrative illustrating ORD interaction with other parts of Agency*	Kira Lynch, Region 10/ORD Amy Pelka, Great Lakes National Program Office
2:20 – 2:35	SHC Overview: Overall goal of project and orient attendees toward the individual tasks, preview highlights of the project and future directions. Presentation may include a match-up between OLEM/Regional priorities and ongoing or proposed research.	David Jewett, Project Lead for 3.61
2:35 – 2:45	Break	

2:45 – 4:15	Poster Session	SHC Principal Investigators and Subcommittee
4:15 – 4:45	Partner Panel Discussion: Panelists provide feedback on research process, research provided, and Agency needs. BOSC asks questions.,	Dan Powell, OLEM Kira Lynch, Region 10/ORD Amy Pelka, Great Lakes National Program Office Diana Cutt, Region 2/ORD Mike Scozzafava, OLEM (via phone)
4:45 – 5:15	BOSC Discussion: BOSC to share observations on posters, presentations, and partners panel discussions.	Subcommittee
5:15 – 5:45	Wrap-up and Adjourn	Robert Richardson and Jace Cujé

Friday, Nov 4*	**Meeting Location: AWBERC Rms. 130-138*****	
Responding to Charge		
8:00 – 9 a.m.	BOSC Subcommittee Discussion & EPA Response to BOSC's Questions	SHC Leadership and Subcommittee
9 a.m. – 12:15 p.m.	Subcommittee Discussion and Writing	Subcommittee
12:15 – 1:00	Working Lunch	Subcommittee
1:00 – 1:45	Subcommittee Discussion and Writing	Subcommittee
1:45 – 2:00	Wrap Up and Adjourn	Robert Richardson and Jace Cujé

***** All times noted are Eastern Time and are approximate.
****** Wrap-up and adjournment may occur any time following the site visits, at the discretion of the DFO and Chairs.
******* Breaks will be at the Chairs' discretion.

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Appendix B: Participants

BOSC SHC Subcommittee Members:

Robert B. Richardson, Chair*
Courtney G. Flint, Vice Chair
Todd BenDor^
Robert Cervero
Andrew Dannenberg
Richard Feiock**
Elena G. Irwin
James Kelly
Carlos Martín
Peter B. Meyer
Earthea Nance
Matthew Naud
I. Leslie Rubin
Mike Steinhoff
John Tharakan
Bill Tomlinson**
**present on Day 1 of the meeting only*
***unavailable for this meeting*
^participated via phone

EPA Designated Federal Officer (DFO): Jace Cujé, *Office of Research and Development (ORD)*

EPA Presenters:

Andrew Geller, *ORD, National Program Director for the SHC Research Program*
Will Anderson, *OLEM*
Justin Babendreier, *ORD*
John Cardarelli, *OLEM*
Ann Carroll, *OLEM^*
Robyn Conmy, *ORD*
Diana Cutt, *Region 2/ORD*
Nickie DiForte, *Region 2^*
Stiven Foster, *OLEM*
Carolyn Hoskinson, *OLEM^*
Wesley Ingwersen, *ORD*
David Jewett, *ORD*
Kira Lynch, *Region 10/ORD*
Michael Nye, *ORD*
Amy Pelka, *Great Lakes National Program Office*
Dan Powell, *OLEM*
Kathleen Raffaele, *OLEM*
Liz Resek, *OLEM^*

Mike Scozzafava, *OLEM*
Cindy Sonich-Mullin, *ORD*
Tim Taylor, *OLEM*
Thabet Tolaymat, *ORD*
Jim Weaver, *ORD*
^*participated via phone*

Other EPA Attendees:

Robert Burgess
Lawrence Burkhard
Jennifer Cashdollar
Karen Chu
Robert Ford
Alice Gilliland
John Glaser
Timothy Gleason
Imtaek Hahn
Michael Hennessy
Tom Holdsworth
Max Krause
Alex Lan
James Lazorchak
Todd Luxton
David Mayer
Melissa McCullough
John McKernan
Marc Mills
Randy Parker
Chris Rea
Teri Richardson
Endalkachew Sahle-Demessie
Mya Sjogren
Michael Slimak
Susan Thorneloe
Leland Vane
Jim Weaver
Dale Werkema

Other Participants:

None

Contractor Support:

Kaedra Jones, *ICF*
Maureen Malloy, *ICF*
Amanda Ross, *ICF*

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Appendix C: List of SHC Materials Provided

(accessible at http://www2.epa.gov/bosc/sustainable-and-healthy-communities-subcommittee-meeting-documents)

Glossary

Charge Questions

Research Plans

- Outputs
- Product and Output Maps
- Project Plan 3.61: Contaminated Sites
- Project Plan 3.62: Environmental Releases of Oils and Fuels
- Project Plan 3.63: Sustainable Materials Management

Accomplishments

- FY15 Accomplishments Report, excerpts from Topic 3
- FY15 Products and Outputs for Topic 3
- Selected OLEM and OW actions supported by SHC Topic 3 Research
- Successful Regional Partnerships
- SHC Topic 3 BOSC Poster Topics, Presenters, and Abstracts

Additional Materials Provided

- Topic 3 Fact Sheets
- SHC Posters (44)
  - SHC 3.61 Contaminated Sites
  - SHC 3.62 Environmental Releases of Oils and Fuels
  - SHC 3.63 Sustainable Materials Management
- Stakeholder feedback summary