



B O S C
Board of Scientific Counselors

**REVIEW OF
U.S. EPA OFFICE OF RESEARCH AND DEVELOPMENT'S
RESEARCH PROGRAMS**

Draft

BOSC Sustainable and Healthy Communities Subcommittee

Robert Richardson, Ph.D. (Chair) <i>Michigan State University</i>	Richard Feiock, Ph.D. <i>Florida State University</i>	Matthew Naud <i>Systems Planning Unit, City of Ann Arbor</i>
Courtney Flint, Ph.D. (Vice Chair) <i>Utah State University</i>	Elena G. Irwin, Ph.D. <i>Ohio State University</i>	I. Leslie Rubin, M.D. <i>Developmental Pediatric Specialists</i>
Todd BenDor, Ph.D. <i>University of North Carolina at Chapel Hill</i>	James Kelly, M.S. <i>Minnesota Department of Health</i>	Mike Steinhoff <i>ICLEI-Local Governments for Sustainability USA</i>
Robert Cervero, Ph.D. <i>University of California, Berkeley</i>	Carlos Martín, Ph.D. <i>The Urban Institute</i>	John Tharakan, Ph.D. <i>Howard University</i>
Andrew L. Dannenberg, M.D., M.P.H. <i>University of Washington</i>	Peter B. Meyer, Ph.D. <i>The E.P. Systems Group, Inc.</i>	Bill Tomlinson, Ph.D. <i>University of California, Irvine</i>
	Earthea A. Nance, Ph.D., P.E. <i>Texas Southern University</i>	

**EPA Contact
Jace Cuje, Designated Federal Officer**

February 9, 2017

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LIST OF ACRONYMS

AOC	Area of Concern
ASTSWMO	Association of State and Territorial Solid Waste Management Officials
BOSC	Board of Scientific Counselors
BUI	Beneficial Use Impairment
CDC	Centers for Disease Control and Prevention
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DASEES	Decision Analysis for a Sustainable Environment, Economy, and Society
DOD	Department of Defense
DOE	Department of Energy
EC	Executive Committee
EGS	Ecosystem Goods and Services
EPA	Environmental Protection Agency
FY	Fiscal Year
GHG	Greenhouse Gases
GLNPO	Great Lakes National Program
HELP	Hydrologic Evaluation of Landfill Performance
HHRA	Human Health Risk Assessment
LCA	life cycle assessment
LOD	linked open data
LUST	Leaking Underground Storage Tank
MSW	Municipal Solid Waste
MWiz	Materials Management Wizard
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEWMOA	Northeast Waste Management Officials' Association
NIEHS	National Institute of Environmental Health Sciences
OBLR	Office of Brownfields and Land Revitalization
OEM	Office of Emergency Management
OLEM	Office of Land and Emergency Management
ORCR	Office of Resource Conservation and Recovery
ORD	Office of Research and Development
OSWER	Office of Solid Waste and Emergency Response
OUST	Office of Underground Storage Tanks
OW	Office of Water
PACT	Partner Alliance and Coordination Team
R2R2R	Remediation to Restoration to Revitalization Approach
RARE	Regional Applied Research Effort
RESTORE	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies
RIMM	Risk-Informed Materials Management
RSL	Regional Science Liaison
SEFA	Spreadsheets for Environmental Footprint Analysis
SHC	Sustainable and Healthy Communities
SHCRP	Sustainable and Healthy Communities Research Program
STL	Superfund and Technical Liaison

StRAP
USDA
VOC

Strategic Research Action Plan
U.S. Department of Agriculture
volatile organic compound

BACKGROUND

The BOSC Sustainable and Healthy Communities (SHC) Subcommittee was established to provide program-specific advice to EPA's Sustainable and Healthy Communities Research Program (SHCRP). The mission of the SHCRP is to conduct research and deliver products that improve the capability of EPA to carry out its responsibilities, including cleaning up communities, making a visible difference in communities, and working toward a sustainable future. SHCRP conducts applied, relevant research and aims to provide the knowledge, data, and tools needed to meet today's needs without compromising the ability of future generations to meet their needs in ways that are economically viable, beneficial to human health and wellbeing, and socially just, while supporting local communities seeking to become more sustainable. SHCRP plans to engage the Subcommittee over the next several years to provide advice on the Program's portfolio and to assess progress in addressing EPA's needs.

The Subcommittee met November 2-4, 2016 at EPA's Andrew W. Breidenbach Environmental Research Center in Cincinnati, Ohio. The focus of the meeting was on SHC Topic 3: Sustainable Approaches for Contaminated Sites and Materials Management. The meeting included discussions about research priorities for the Office of Land and Emergency Management (OLEM) as well as panel discussions and poster sessions related to the following three projects:

1. Project 3.61: Contaminated Sites
2. Project 3.62: Environmental Releases of Oils and Fuels
3. Project 3.63: Sustainable Materials Management (SMM)

To situate Topic 3 in the broader context of the SHC Program, the following is the full set of SHC Topics:

- Topic 1: Decision Support and Innovation
- Topic 2: Community Wellbeing: Public Health and Ecosystem Goods and Services
- Topic 3: Sustainable Approaches for Contaminated Sites and Materials Management
- Topic 4: Integrated Solutions for Sustainable Communities

STRAP TOPIC 3: SUSTAINABLE APPROACHES FOR CONTAMINATED SITES AND MATERIALS MANAGEMENT

This topic provides research and technical support for cleaning up communities, ground water, and oil spills, restoring habitats and revitalizing communities, and advancing sustainable waste and materials management. Specifically, this work will help partners and stakeholders improve the efficiency and effectiveness of addressing contaminated sediments, land, and ground water and resultant vapor intrusion. SHC research will also provide and evaluate standards, products, data, and approaches to prevent, characterize, and clean up environmental releases of petroleum and other fuel products. SHC methods, models, tools, and data will enhance sustainable materials management.

Project 3.1[†]: Contaminated Sites

It is important to reduce or prevent human exposure to contaminants and to ensure that ground water quality meets drinking water standards. Contaminated ground water is found at most Superfund sites and cleanup can take decades to complete. Subsurface contamination can also be the source of volatile contaminants that enter residences or businesses, known as vapor intrusion, and expose individuals to

hazardous pollutants. Discharge of contaminated ground water may increase contaminant loadings to sediments and to surface water. This project will build on previous contaminated sites research and will involve the assessment of metrics for remediation, restoration, and revitalization in a context of potential spatial and temporal changes due to various factors, including climate change. The three focus areas of this project are:

1. *Technical Support for Contaminated Sites*: ORD will continue to provide valuable assistance to EPA programs to deal with contaminated sites and regional offices through five technical support centers, three of which are supported by SHC: Ground Water; Engineering; and Monitoring and Site Characterization.¹ Knowledge obtained through these activities provides the basis for designing future research.
2. *Research on Site Characterization, Remediation, and Management*: This area includes research on contaminated ground water and sediments and vapor intrusion. Priorities for ground water research include: improving the application and interpretation of high resolution characterization technologies; characterizing sites and mitigating contamination via back diffusion; and developing and evaluating improvements in treatment delivery and extraction technologies and strategies to clean up contamination. Priority research for contaminated sediments includes: better understanding linkages between contaminant concentrations in sediment and fish tissue concentrations, improving analytical technology to evaluate hydrophobic organics and metals in soil and sediment, and evaluating the effectiveness of remediation alternatives and their associated impacts. Research on vapor intrusion will address the use of external remedial controls to reduce vapor intrusion and decrease the need for in-structure intrusive sample collection or in-building remediation systems.
3. *Research on Temporal and Spatial Impacts of Contaminated Ground Water – Site Reuse, Revitalization, and Environmental Justice*: The goals of this focus area are to understand the temporal and spatial changes in ground water, vapor intrusion and contaminated sediments in conjunction with social and economic factors related to community water supplies to address environmental justice concerns, Great Lakes Areas of Concern, and Brownfields needs. Research includes understanding aquifer vulnerability and private water well use, contaminant plume transport and its impact on public and private water supply wells, and social and economic factors which influence water use and water valuation.

Project Highlights

- Technical Support Center annual reports
- A decision-support system to guide the use of geophysical characterization and monitoring technologies for environmental investigations
- Report on flux-based site management
- Methods for testing freshwater sediment toxicity and bioaccumulation
- Spatial assessment of contaminated ground water at hazardous waste sites near vulnerable drinking water supplies

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¹ The other two technical support centers, Superfund/Human Health and Ecological Risk Assessment Technical Support Centers, are supported by ORD's Human Health Risk Assessment (HHRA) research program, and there is coordination among all five centers across the two programs.

Project 3.2[†]: Environmental Releases of Oils and Fuels

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 and potentially affect human health and the environment through their impacts on water quality (including drinking water supplies) or direct exposure to toxic constituents. Innovative research approaches will help to achieve more efficient and effective management of oil spills, including fuel. This research supports development of improved protocols, guidelines, regulations, and response efforts to protect communities from exposures to environmental releases of oils and fuels. The private sector will use these protocols to advance remediation/response technologies for various conditions and oil products.

This project addresses impacts to community public health and ecosystems of oil spills and leaking underground storage tanks:

1. *Oil Spills*: Research will focus on two aspects of spill response: (1) spill preparedness via product testing protocols, and (2) innovative spill response options tailored to specific oils and environments, including sustainability dimensions of competing actions. This includes research to better understand the environmental impacts of oil spills (including non-petroleum oil) and dispersants as well as research to develop innovative and more sustainable technologies to assess and mitigate the impact of oil spills.
2. *Leaking Underground Storage Tanks*: Research will focus on understanding emerging fuel compatibility with tanks as well as modeling and remediating contaminant plumes resulting from leaking underground tanks and their impacts on buildings and water supplies, both private and public. The research is intended to: (1) develop an improved conceptual model for plume formation and migration from petroleum hydrocarbons, ethanol, and other additives; (2) develop a better understanding of fuel behavior at the water table and impacts to water supply wells resulting from precipitation changes due to climate change; and (3) develop the capacity to identify areas with high density of private wells, potentially leaking tanks, redevelopment sites, and proximities to water supplies.

Project Highlights

- Report on development of a surface washing agent effectiveness protocol for products on the National Contingency Plan Schedule
- Report on the biodegradation and toxicity of diluted bitumen crude oils to determine fate of bitumen discharged in water
- Report on ethanol corrosion studies and ongoing technical support to states
- Report on density of domestic water well locations and proximity to leaking underground storage tanks and potential brownfields sites, through the use of GIS tools

Project 3.3[†]: Sustainable Materials Management

The goal of this project is to enable partners and stakeholders to minimize environmental impacts associated with products and materials through reduced consumption and increased reuse and recycling. Specifically, the research will develop and demonstrate life cycle assessment paradigms and material, product, and process design strategies that lead to reduced environmental impacts while preserving natural capital. Greenhouse gas emissions will be an important aspect of this project as well.

This project includes three focus areas:

1. *Life Cycle Management of Materials*: This focus area will consider both sustainable materials management and life cycle assessment (LCA) to develop an integrated framework to support decision-making. Other methodologies for community materials management, such as urban metabolism², will also be explored. This project will develop life cycle inventory data focused on end-of-life materials management processes (e.g., landfilling, recycling), which are existing data gaps and will help develop data for baseline modeling scenarios. Data developed in this project will be openly available through an EPA portal to the Federal LCA data commons³. LCA work is done in coordination with related efforts in other programs, such as CSS.
2. *Reuse of Organics and Other Materials*: This focus area will develop dynamic approaches to assist communities in enhancing energy generation and materials recovery from existing waste streams or underutilized material flows. Reuse of materials (e.g. industrial, agricultural, and organic and inorganic sources) may offset the use of virgin materials in products or processes and potentially lead to reducing their adverse effects on the environment and human/ecosystem health. Included in this focus area is research in conjunction with the U.S. Army's Net Zero initiative. The Net Zero Initiative enables the Army to appropriately safeguard available resources and manage costs by reducing the generation of solid waste.
3. *Regulatory Support*: This focus area will provide technical support, primarily to OSWER on various aspects of sustainable materials management. We expect these issues to evolve over time. Examples of previous support focus on coal combustion residues, use of the leaching environmental assessment framework, and evaluation of empty pharmaceutical containers. Electronic waste is another important area for EPA under the National Strategy for Electronics Stewardship. There is a lack of coherent information on the domestic movement of used electronics, so SHC will address this need and, if possible, develop an online tracking tool.

Project Highlights

- Publicly accessible EPA portal to the LCA commons installed on a linked open data (LOD) server
- Risk-Informed Materials Management tools system, technology transfer, and demonstration applications (e.g., reuse scenarios for biosolids)
- Comprehensive assessment of the flow of used electronics for selected states
- State of the practice for construction demolition and recycling
- Resiliency of waste containment systems to extreme weather events

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² Kennedy et al. 2007 define urban metabolism as “the sum total of the technical and socio-economic process that occur in cities, resulting in growth, production of energy and elimination of waste.” Source: Kennedy, C., Cuddihy, J., and Engel-Yan, J. (2007). The changing metabolism of cities. *Journal of Industrial Ecology*. 11(2), 43-59.

³ <http://www.lcacommons.gov/>.

[†] For consistency, the number “6” was removed from each Project name.

CHARGE QUESTIONS AND CONTEXT

Overall Goal of BOSC Meeting

BOSC will provide SHCRP with feedback to shape its research in the areas of contaminated sites and sediments, environmental releases of oils and fuels, and sustainable materials management to be responsive to near- and long-term Agency, state, and community needs. The SHCRP is focused on securing a healthy environment for all. Its research portfolio is broad, comprising research on environmental public health, ecosystem services, indicators and indices, and sustainable approaches for contaminated sites and materials management. SHC's long-term goal is that this research is built into tools and structured decision-making methods that facilitate integrated risk and impact assessments, and that are accessible to and usable by communities, leading to sustainable communities and resources.

This review focuses on Sustainable Approaches for Contaminated Sites and Material Management. This research area links most closely to EPA's OLEM, with research focused on addressing pressing Agency needs for both near-term solutions and long-term strategies. Because of this and to follow up on the general charge questions from the initial BOSC subcommittee review, the first two charge questions focus on SHC's responsiveness to immediate and future needs in this area.

Charge Questions

The Subcommittee was charged with three questions. A description of the context for these charge questions is presented below, followed by the charge questions themselves.

Context: SHC's Objective 3 pledges to

Provide research and technical support for cleaning up communities, ground water, and oil spills; restore habitats and revitalize communities; and advance sustainable waste and materials management.

SHC has developed three research projects that specifically address this objective and describe the goals and planned products of these in the SHC Strategic Research Action Plan (StRAP) Fiscal Years (FY) 2016-2019, the SHC Outputs document, and the Project Plans, which were developed by each project team. Much of this Topic 3 research is oriented toward addressing near-term Agency needs in the areas of cleaning up contaminated sites and oil spills and supporting Agency and state-delegated programs with respect to waste and materials management. Some of the proposed research, however, is focused on longer-term goals, such as understanding the steps that will lead a community from remediation of a contaminated site to restoration of ecosystem services to community revitalization. Other longer-term research includes information to help states, communities, and organizations understand how to use locally available non-regulated agricultural or fisheries waste as a feedstock for materials that can sequester carbon or help to remediate contaminated sites.

There are two questions assigned to each of the three projects in Topic 3: Sustainable Approaches for Contaminated Sites and Materials. The Subcommittee's review of SHC's research plans (StRAP, Outputs, and Project Plans) and accomplishments (poster abstracts, FY15 products, and other supporting material), together with the outcomes of discussions with Program and Regional office partners about their research issues and national, state, and community issues in this topic area informed the Subcommittee members' responses to the following questions:

Charge Question 1. How well do SHC's R&D accomplishments and proposed research address high priority Agency, state, and community needs in this area?

1. *Project 3.61 - Contaminated Sites*
2. *Project 3.62 - Environmental Releases of Oils and Fuels*
3. *Project 3.63 - Sustainable Materials Management*

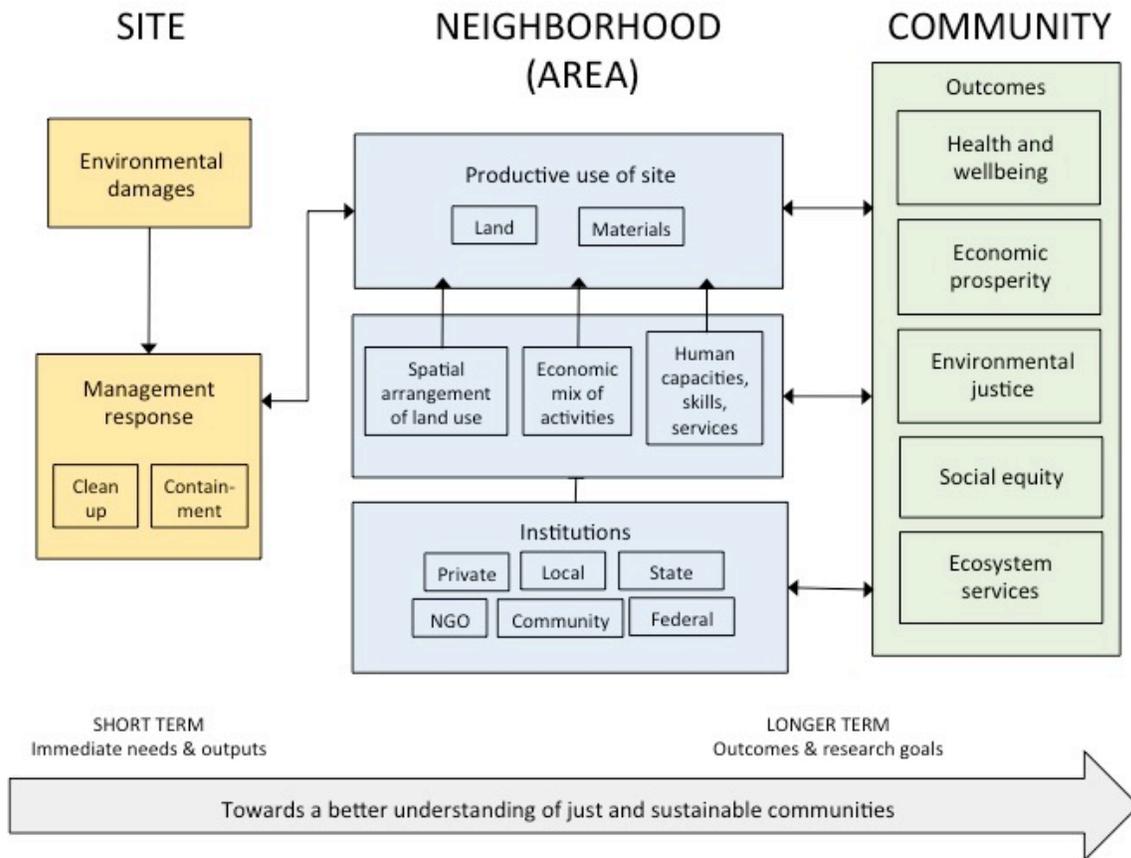
Charge Question 2. How well does SHC's planned research anticipate future problems in this area and address longer-term community sustainability and environmental justice goals?

1. *Project 3.61 - Contaminated Sites*
2. *Project 3.62 - Environmental Releases of Oils and Fuels*
3. *Project 3.63 - Sustainable Materials Management*

Additional Charge Question

Context: SHC holds that cleaning up contaminated sites and developing approaches to avoid the creation of new contamination and waste sites is prerequisite to communities achieving sustainability. In its initial (2015) review of SHC, the BOSC SHC Subcommittee provided a preliminary framework for linking site-specific management with broader community social, economic, and environmental goals. This framework is provided below in Figure 1.

Figure 1: Conceptual framework for holistic approach to linking site-specific management with broader social, economic and environmental assessment of sustainable communities



Charge Question 3. How are SHC Sustainable Approaches for Contaminated Sites and Materials projects, and associated research from other parts of SHC, helping communities achieve sustainability?

RESEARCH TOPIC 3

Topic 3: Sustainable Approaches for Contaminated Sites and Materials Management

The SHC StRAP outlines the ORD’s role in achieving EPA’s objectives for cleaning up communities, making a visible difference in communities, and working toward a sustainable future. Topic 3 is one of SHC’s research topics that guide specific research and development (R&D) activities for addressing the objective-specific “Science Challenges” as set forth in the SHC StRAP.

This topic provides research and technical support for cleaning up communities, ground water, and oil spills, restoring habitats and revitalizing communities, and advancing sustainable waste and materials management. Specifically, this work will help partners and stakeholders improve the efficiency and effectiveness of addressing contaminated sediments, land, and ground water and resultant vapor intrusion. SHC research will also provide and evaluate standards, products, data, and approaches to prevent, characterize, and cleanup environmental releases of petroleum and other fuel products. SHC methods, models, tools, and data will enhance sustainable materials management.

PROCESS

Review of Materials

The SHC provided a suite of materials for the Subcommittee in October 2016, including:

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 Office of Water (OW) actions supported by SHC Topic 3 Research
- *Successful Regional Partnerships
- SHC Topic 3 BOSC Poster Topics, Presenters, and Abstracts

Additional Materials Provided

- *Agenda - front pocket of BOSC Book
- *Topic 3 Fact Sheets - research plans section
- SHC Posters (44) – accomplishments section
- Additional abstract – accomplishments section
- Revised poster list – accomplishments section, replace existing list
- Stakeholder feedback summary – research plans section

Note: * indicates items SHC suggested reviewing first in case of limited time to prepare.

Subcommittee members reviewed these documents prior to the face-to-face meeting.

Subcommittee Meeting

The Subcommittee convened for a public meeting to prepare the review of research Topic 3 at EPA's Andrew W. Breidenbach Environmental Research Center in Cincinnati, Ohio on November 2-4, 2016. The agenda is attached as an appendix to this report. The meeting included discussions of research priorities with staff from the OLEM (formerly Office of Solid Waste and Emergency Response [OSWER]), as well as poster sessions, partner panel discussions, and ORD research laboratory tours. The Subcommittee worked in full group and breakout groups to discuss and address the charge questions and associated recommendations. Interaction between OLEM and SHC staff and the Subcommittee throughout the meeting allowed for clarifications and are captured in the minutes from the meeting.

Post-Meeting Response to Charge Questions

Members continued to collaborate via e-mail in small groups to finalize the responses to the charge questions in the weeks after the face-to-face meeting. These responses were synthesized into this report, distributed to members for final consensus review, and finalized by the SHC Subcommittee chairs in December 2016.

SUBCOMMITTEE RESPONSES TO CHARGE QUESTIONS

Subcommittee Feedback on Charge Questions

General Observations

Based on the materials available and presented to the Subcommittee, our overwhelming reaction is that the basic science being conducted on environmental toxins, pollutants, and sustainable materials management and how these can be mitigated or eliminated is impressive. Overall the BOSC SHC Subcommittee was very impressed by the scope and quality of research that was presented in this regard.

ORD's Partner Alliance and Coordination Team (PACT) as proposed and currently being developed is a commendable effort and could make good progress towards its overarching goal of fostering two-way communication with Program and Regional Partners. Findings from a survey of ORD partners revealed high ranking of prioritizing research needs, disseminating research to potential Agency users, and jointly defining research outputs ranked highly. It would be helpful to know if the PACT intends to address those questions and needs and if they have any strategies to do so. The research road maps seem to be a good idea for integrating research across programs.

SHC faces a general challenge in connecting the implications of the environmental science research to contaminated sites, oils and fuels, and sustainable materials management to broader community sustainability and environmental justice goals. Such integration requires understanding not only of the basic science, but also of the human dimensions (e.g., economic, social, behavioral, and political factors), and the linkages between the human and environmental systems. Such applied dimensions investigate how the presence of environmental pollution and associated toxins, or sustainable materials management, affect the community, e.g., in terms of the environmental justice implications of remediation and how the impacts of environmental pollution translate into measures of individual and community well-being. Balancing these competing needs is exceedingly challenging in a highly resource-constrained environment.

The charge questions presented to the BOSC are oriented largely toward the applied dimensions of Topic 3 efforts, while much of the materials presented and discussed at the meeting focused on the basic science elements. In this report, we focus on the charge questions as given to us, with recognition of these inherent challenges.

Responses to each charge question are organized by general observations across projects and accompanying recommendations followed by project specific observations and recommendations. Elements to be considered, but that do not rise to the level of a formal recommendation are found throughout the text.

Charge Question 1. How well do SHC's R&D accomplishments and proposed research address high priority Agency, state, and community needs in this area?

General Observations and Recommendations

Across all three projects, SHC appears to be engaging in exemplary research that supports the priorities of the Agency, and to a good extent, states and regions. While community needs are often indirectly incorporated into Topic 3 research, this is where we see the greatest need for direct attention, expanded resources (both funds and expertise), and institutional investment.

Overall, greater attention to systematically assessing Agency, state, and community needs is warranted. Towards this end, it may be possible to expand the PACT approach to create more interaction with these stakeholder groups. Improvements in science communication will help to improve responsiveness to community needs across all Topic 3 efforts.

More robust formal planning efforts like PACTs should contribute significantly to ORD responsiveness. The Subcommittee supports this effort and only recommends providing more explicit deadlines and requirements of engagement to ensure that all stakeholders participate in a timely manner. SHC might consider approaches to the publication of research findings that enable partner organizations and local level technical assistance providers to design and deliver relevant information and resources tailored to meet the needs of their stakeholders.

Recommendations

General Recommendation 1.1: Follow the principles of community engagement (e.g., build relationships from the ground up versus top down) to build trust and ensure priorities are based on local issues and needs.

General Recommendation 1.2: Engage communications and social science expertise to develop a set of metrics to gauge communication effectiveness as well as provide EPA program and regional staff with the tools for articulating actionable research agendas.

Project Specific Observations and Recommendations

Project 3.61 - Contaminated Sites

Project 3.61 is engaging in exemplary research that supports the priorities of the Agency. For example, ORD provides technical support to OLEM's Office of Resource Conservation and Recovery (ORCR) to update and improve models, including the Waste Reduction Model (WARM) and Hydrologic Evaluation of Landfill Performance (HELP) models. OLEM works with ORD to update risk-informed materials management and multi-media models.

SHC is also addressing some of the most vexing questions that are relevant to states regarding contaminated sediments, emerging contaminants, and vapor intrusion. We saw ample evidence of involvement in a variety of projects in different states related to identifying toxins, measuring them and developing strategies for remediation, including: Sustainable Remediation of Arsenic and Chromium in Groundwater; Spatial and Temporal Variability at the Indianapolis Test Duplex; Determining Urban Lead Background Concentrations in the SE U.S.; Measuring Contaminant Mass Flux and Groundwater Velocity in a Fractured Rock Aquifer Using Passive Flux Meters; Tri-State Mining District Modeling, Technical and Decision Support; Regional Applied Research Effort (RARE) Urban Background Study.

Successful partnerships between ORD and EPA Regions illustrate the critical role that SHC's Technical Support Centers play in addressing issues in remediating contaminated sites and the critical role that ORD plays more broadly in providing expertise, such as the partnership between Great Lakes National Program (GLNPO) and ORD and the technical support provided to Region 10 for lead remediation. The availability of funds to support these partnerships, including the Superfund and Technical Liaison (STL) and RARE, funding, is critical and has generated high-valued applied research that responds to high-priority needs of the community and Regions. The project "Superfund Remedial Action Decision Process and Community Involvement Support with Decision Analysis for a Sustainable Environment, Economy, and Society (DASEES)" is an excellent example of how site-specific research has incorporated broader neighborhood and community concerns. Other examples of how ORD has been responsive to community concerns through engagement efforts include the ORD partnership with Region 10 that supports community engagement with Superfund sites; the engagement of the community in the Brownfield(s) program to address the unintended consequences of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); and GLNPO's use of local community groups to determine how to best eliminate Beneficial Use Impairments (BUIs) from Areas of Concern (AOCs).

ORD is conducting exemplary research on incorporating the broader concerns of communities into site-specific projects. For example, the "Remediation to Restoration to Revitalization Approach" (R2R2R) for the Great Lakes National Program Office Areas of Concern develops a more holistic framework for understanding the linkages between remediation and restoration activities and ecosystem health and service outcomes, and how these relate to revitalization. In addition, we commend the research summarized by the poster "Understanding and Evaluating Ecosystem Goods and Services (EGS) at Site Remediation Projects and Applying Their Benefits to Sustainability and Livability for Surrounding Communities" for linking ecosystems assessments to sustainable-communities practice. These provide excellent examples of how ORD is integrating consideration of broader community sustainability goals into research that responds to the core Agency mission of protecting human health and the environment at contaminated sites. We encourage the use of the AOCs as a model for engaging community stakeholders in determining the priorities and best approaches for remediation and clean up.

Nonetheless, the bulk of the work under Task 3.61 focuses on research to support site remediation and cleanup with limited consideration for broader community concerns or impacts. There remains a need for going beyond basic science and tools development to permit consideration of individual and community values, the impacts of contamination and the interventions on community health and well-being, and the consequences for community restoration and revitalization. Research related to revitalization efforts seem to be given relatively less emphasis than the charge of site remediation and restoration, as reflected by research conducted to date on Task 3.61. This may be due, in part, to the longer-term nature and diffuse impacts and beneficiaries of revitalization vis-à-vis remediation and restoration. Furthermore, the complexity of revitalization may require expanding the skill sets of the research team to integrate knowledge from the social sciences. We note that some of the tools that have been developed as part of other projects (e.g., Human Wellbeing Index, EnviroAtlas, and the Eco-Health Relationship Browser) are incorporating the social sciences and moving in this direction.

We acknowledge that SHC faces a number of challenges related to carrying out research related to Task 3.61. In addition to the overarching challenge of operating in an environment with very scarce resources, SHC faces challenges in relating "on the ground" community needs to ORD science that is being conducted. This is in part due to the need to rely on partners to inform them of the community needs, given that ORD scientists are several steps removed from direct community engagement.

Recommendations: Project 3.1

Recommendation 1.1: Improve community engagement by informing Task 1 (providing technical support) with information from Task 5 (tools for evaluating spatio-temporal impacts of contaminated sites on the environment).

Recommendation 1.2: Increase opportunities for collaboration within ORD and with other federal agencies, such as the Centers for Disease Control and Prevention (CDC), the Department of Energy (DOE), the Department of Defense (DOD), the National Institute of Environmental Health Sciences (NIEHS), etc. in order to leverage research to advance the aims of site revitalization and urban regeneration.

Project 3.62 – Environmental Releases of Oils and Fuels

The Subcommittee concluded that the scientific research efforts associated with Environmental Releases of Oils and Fuels (Project 3.62) are exceptional and directly meet needs for information on a) behavior, fate, and effects of oil and spill agents; b) protocol development for the National Contingency Plan product schedule; c) leaking underground storage tanks; and d) research collaboration and dissemination.

Overall, there appear to be strong and very successful intra-Agency partnerships between ORD and OLEM's Office of Emergency Management (OEM), and Office of Underground Storage Tanks (OUST) in Project 3.62, and ORD appears to respond well to Agency requests for technical assistance and with information for first responders. The Agency has also collaborated with National Response Teams, EPA Regions, and the Canadian Government on its oil and fuels research. Project 3.62 has developed valuable tools and information and has disseminated its research findings to diverse audiences at federal, state, tribal, and regional levels. Deliberations with EPA partners and other agencies have refined and focused research priorities. It is encouraging to know that ORD has Superfund and Technology Liaisons and Regional Science Liaisons (RSLs) to connect research and regions.

The Subcommittee notes that incorporating feedback from emergency response personnel working in the field would help to assess the applicability of research on oils and fuels and whether it is meeting partner, state and local needs. Further, there may be important information on oil and dispersant behavior in real spill situations that can be systematically collected from first responders that would inform future research efforts.

In providing critical information to spill responders as well as technical assistance more broadly, SHC research in Project 3.62 appears to be addressing needs from states and tribes. Furthermore, Leaking Underground Storage Tank (LUST) research recognizes that states vary considerably in their objectives, policies, and practices related to leaking underground storage tanks. Recent conversations with state partners are expected to occur annually moving forward and this will continue to help ORD research address these needs.

Efforts to mitigate impacts from releases of oils and fuels certainly help to protect communities from these environmental hazards. Beyond that, however, direct response to community needs is the least explicit area in Project 3.62 reporting. Integrating external data sources, such as human health, income, and housing data, can help to identify vulnerable communities. Including communities in the development and dissemination of tools and models can increase the applicability, value, and relevance of the research to impacted communities. Furthermore, using real-world emergencies (i.e., case studies) to understand the direct impacts of oil and fuel releases on communities can offer a more holistic perspective and can help ground truth the basic research.

With regard to National Oil and Hazardous Substances Pollution Contingency Plan (NCP) products testing, more direct communication of research findings on dispersant effectiveness and toxicity would likely be appreciated by affected local communities, though we understand that these direct contacts may be the role of regional partners and OLEM staff more than the ORD SHC researchers themselves.

ORD should seek opportunities to meet directly with locals (e.g., cities) to insure that ORD develops tools are reaching their intended audiences and that local needs are elevated to EPA through states and regions. Some states are less restrictive in requiring LUST cleanup in areas served by municipal water. There is concern at the local level about the integrity of municipal waterline gaskets surrounded by volatile organic compound (VOC) contamination and the ability of residual VOC contamination entering municipal stormwater and sanitary lines via infiltration. ORD's work on volatilization to indoor air is an important area of research that directly supports protection of public health in urban environments.

Addressing the backlog of 78,000 leaking underground storage tanks is also important to local communities. The contextualization of LUSTs with water supply well mapping shows the localized focus of LUST research that is important to addressing community needs. Working with states to improve data quality on interactions between backlogged LUST sites and proximate water supplies will help to make the research more directly helpful for communities.

Recommendations: Project 3.2

Recommendation 1.1: Facilitate feedback from state and local oil spill responders to assess utility of research in the field and to inform research on oil and dispersant behavior in real spill situations.

Recommendation 1.2: Incorporate more direct ways to respond to local community needs in the context of oil spills and leaking fuel tanks and to validate basic research in local settings.

Recommendation 1.3: Facilitate the exchange of information that would improve data quality on proximate water supplies to investigate interactions of groundwater sources and backlog LUST sites.

Project 3.63 – Sustainable Materials Management

Despite fiscal constraints, SMM projects appear to be of both high methodological quality and generally well recognized by scholars, professionals, and policy advocates (especially WARM and HELP and potentially Risk-Informed Materials Management [RIMM] and the Materials Management Wizard [MWiz]).

Currently, SHC's Project 3.63 work appears to satisfactorily address the Agency's priorities based on program and regional testimony. Respondents describe the current state of ORD's responsiveness as significantly improving upon past efforts with regard to coordination of research needs and project execution.

To the extent that EPA programs and regions reflect state and community needs, SHC's work is also responsive to them. However it was noted among practitioners on the BOSC that there is a disconnect between the work that SHC develops for end users at the state level that does not always translate to local community decision makers. This is evident in both the challenges of downscaling SHC developed tools and datasets to local contexts as well as the existing partnerships that were highlighted in materials presented to the BOSC. For example, there were several points of reference to positive collaboration with the Association of State and Territorial Solid Waste Management Officials (ASTSWMO), but no examples were highlighted of working to incorporate needs of similar groups that work more closely at the local

level such as the Northeast Waste Management Officials' Association (NEWMOA) or the Region 9 supported West Coast Climate and Materials Management Forum, two examples of such groups.

In terms of outcomes, there are numerous high quality and useful research products that currently come from the SMM program area. The WARM Model and the underlying research that powers the model are a foundational piece that greenhouse gas (GHG) emissions management decision makers rely upon. Particularly commendable is the changes in recent years to publish extensive documentation about the model in ways that allow the research done for the development of WARM to be leveraged by other tool and technical assistance providers. Similarly the annual Municipal Solid Waste (MSW) Facts and Figures report fills critical information gaps for many local practitioners who lack the capacity for local characterization studies. However there are examples of where R&D accomplishments do not currently meet the needs of community practitioners, such as the lack of coverage of the GHG implications of management options for biosolids in the WARM model despite the fact that it is a waste type, which with all communities must contend.

We recognize that for SHC research to be effective, OLEM must have the staff capacity to accurately gauge local/state government, industry, and civil sector research needs, and in turn translate SHC findings and disseminate tools appropriately and engage communities in pilots, demonstrations, or tool use. We encourage increasing fellowships and scholarly exposure for the broader research community to SHC laboratories and research facilities, as this may help to increase staffing expertise and visibility where resources continue to be severely constrained. This engagement may also lead to leveraging funds with other Federal and academic researchers.

Included in this capacity is outreach and coordination with other Federal research efforts (such as the U.S. Department of Agriculture (USDA)'s agricultural waste research) that are critical to the study of comprehensive materials management but whose policy and program silo each component material or material process. Supporting these connections is key to SHC's success in meeting needs at multiple scales. Informal communications were noted as key contributors to successful partnerships in SMM. While PACT and other formalization efforts can assist in documentation and negotiation, they cannot replace the scholarly benefit and interpersonal trust developed informally. The Subcommittee recommends staff details across ORD and OLEM, more frequent presentations of works-in-progress, and similar informal strategies.

Recommendations: Project 3.3

Recommendation 1.1: Formalize more opportunities for informal communications between OLEM and ORD's SHC staff to ensure longer-term input into SHC's research plans and responsiveness to research needs.

Recommendation 1.2: Increase efforts to survey the landscape of other SMM scholars, federal policy staff, practitioners and potential partners that work directly in communities as opposed to reaching communities indirectly through states.

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?

General Observations

We recognize that funding levels and staffing constraints influence SHC's capacity to respond to future research needs. Research funding levels, including both the magnitude of resources in OLEM and that allocated by ORD, are often limited and fixed research resources. Furthermore, SHC staff availability and expertise, given recent retirements and the geographic disparate nature of ORD's researchers may also present complications. Where appropriate we encourage expansion of opportunities for graduate students and post-doctoral fellows to work at EPA in short-term assignments and to serve as a pipeline for future long-term employees in order to ensure the capacity to address long-term trends and needs, particularly considering an aging Agency workforce.

Project Specific Observations and Recommendations

Project 3.61 - Contaminated Sites

Anticipating Future Problems: The planned research as articulated in the materials and presentations provided for this review shows that ORD is cognizant of doing research that is forward-looking and responsive to longer term community sustainability and environmental justice goals. For example, Dan Powell's presentation emphasized the need to go beyond research on remedy effectiveness (while also acknowledging that this remains an important area) to developing tools for assessing restoration effectiveness and conducting research on revitalization largely through proof of concept and case studies.

Addressing Long-Term Community Sustainability: One question is the extent to which ORD in its current configuration should be solely responsible for this component of the research, given the much broader set of disciplines and research expertise that this entails. A full consideration of community sustainability and environmental justice includes not just the health of people and ecosystems, but also economic impacts (e.g., jobs), ecosystem services, and social impacts (e.g., justice and inclusion). The necessary financial investment in a cleanup is usually very high and therefore a thoughtful cost-benefit analysis that considers personal and community health and economic and social impacts is critical.

Addressing Environmental Justice Goals: Another consideration is the lack of personnel to do the translational work in communicating science to public as well as social science expertise to inform and evaluate such endeavors. To effectively engage the community and communicate the science, there is a need for including outreach professionals into the planning and execution of projects. This goes beyond communicating results and training stakeholders in using decision-making tools. If the community can feel a part of the process then it will be empowered to continue to protect its environment and prevent the likelihood of further contamination. Relatedly, communities may value different components of sustainability and environmental justice differently, emphasizing the need for participatory research in which the research outcomes and metrics are developed in partnership with community stakeholders. Addressing complex environmental problems such as site contamination require broad stakeholder engagement and a multi-disciplinary perspective throughout the process. Another aspect of community engagement is fostering environmental health literacy to develop a better understanding of the communities in which contamination occurs, including the cultural, social, and economic elements that both influence the location of contamination and are changed by it.

A challenge in conducting this broader research is moving beyond research on contaminated sites, which necessitates a historical view, to research that anticipates future trends and challenges and that focuses more on the link between preventing contamination and promoting community sustainability and environmental justice goals. This requires research that goes beyond the science of remediation and elimination of toxins to research that examines how and why the toxins came to be located at the site, the systemic factors that are associated with contaminated sites, and the costs and benefits of alternative strategies for mitigation and prevention. In particular, a better understanding of the social context is critical. For example, that contaminated sites are often in neighborhoods that are under-resourced, under-served, and under-represented, and the implications of these conditions for building institutional capacity and empowering under-resourced communities.

In casting an eye to the future, there are many uncertainties, such as demographic and income shifts, technological innovations, and climate change that will alter the incidence, spatial distribution, and impacts of contaminated sites and the availability and costs of strategies to address these. Population growth implies increased production of waste, new types of waste with changing technology (e.g. electronic waste), and contamination that spreads across the world in ways that link distant places. Changes in climate and weather interact in complex ways with food, energy, water and land resources and in ways that often have disproportionate effects on low-income populations. Energy transmission systems including weather-vulnerable transmission lines and pipelines that may experience spills pose very localized community risks. These broader forces have implications for the political economy of contaminated sites and their management to achieve longer-term community sustainability and environmental justice. Examples of these broader research areas include community engagement strategies for developing community sustainability and models for valuing community capital stocks, including non-contaminated land and other types of natural capital, that can be used to guide land use and management decisions and estimating the benefits and costs of alternative mitigation, remediation and prevention strategies to improve ecosystem services.

Recommendations: Project 3.1

Recommendation 2.1: Strengthen internal and external partnerships to leverage resources to address broader community sustainability and environmental justice research questions by incorporating community engagement expertise as well as social science expertise in economics, education, psychology, sociology, anthropology, health care and mental health, urban development and planning.

Recommendation 2.2: Develop predictive modeling tools that can be used to explore alternative futures and the implications of future demographic, economic, social, environmental, and urban trends to better understand and manage contaminated sites.

Project 3.62 – Environmental Releases of Oils and Fuels

Anticipating Future Problems: Subcommittee members suggested future casting out to 15 years or so to help anticipate future research needs. Increased drilling and gas and oil pipelines pose future problems with direct relevance to research on environmental releases of oils and fuels. Task 3.62.1 is addressing the changing context of oil spills by evaluating oil and dispersant behavior in hypersaline waters such as those that may occur due to coastal storms or rising seas. Consideration might also be given to extreme weather events and interactions with oil spills.

Task 3.62.3 anticipates changing groundwater conditions associated with climate change and extreme weather events, but might also consider additional water demand and land use related changes affecting

groundwater and built infrastructure that might have implications for addressing leaking underground storage tanks and associated vapor intrusion.

In line with Project 3.62's focus on prevention, the Subcommittee notes that anticipating increasing complexity in energy geography associated with new sources and types of fuels as well as changing transportation and utility networks is of critical importance. Tasks 3.62.1 and 3.62.2 are addressing changes in oil types and effectiveness of dispersants in their focus on unconventional oils such as diluted and synthetic bitumen crude oils. Maintaining research capacity to respond to emerging oils and dispersant options is essential. We see evidence of consideration of changes in the geography of oil production and transportation networks associated with oils and fuels in SHC research. It is important that this capacity be maintained and enhanced as needed to address new land-water-oil/fuel-dispersant interactions. Task 3.62.3 does address ethanol fuel and associated corrosion issues as a good example of responding to and anticipating emerging issues.

Maintaining adequate resources and staffing to ensure continuity and expansion of the knowledge base in the area of environmental releases of oils and fuels is essential. Furthermore, it is essential that reference oils and fuels for testing be procured for Project 3.62 research. We understand that comparing oils simulants with actual oil is a next research step and one that we agree is very important (also testing simulants and reference oils in different water salinities).

Recommendations: Project 3.2

Recommendation 2.1: Expand research capacity to anticipate future changes in oil and fuel types as well as changing geographies associated with new extraction and transportation networks.

Recommendation 2.2: Prioritize the procurement of reference oils and fuels for testing.

Addressing Long-Term Community Sustainability: Communities affected by spills or leaking underground storage tanks are not just concerned with immediate risk mitigation, but also the longer-term restoration of their built and natural environments. However, the Subcommittee recognizes constraints in place-based communities on links to regulatory structures (RESTORE Act) that may make restoration from oil spills and leaking underground storage tanks beyond the mandate for Project 3.62.

In terms of oil spills, the Subcommittee acknowledges that critical technical assistance and information for first responders includes local communities. This focus, however, is only a short-term community need. Characterizing toxicity levels associated with products on the NCP list would help to avoid long-term community sustainability issues. It may not be too early to begin exploring the decarbonization of fuel supplies and what effects that may have on releases to the environment. For example, could we expect an increase in abandoned LUST sites as more vehicles move to alternative fuels, such as cheaper natural gas?

Addressing Environmental Justice Goals: The Subcommittee recognizes that the entire focus of Project 3.62 is on mitigating threats associated with oil spills and leaking fuel tanks, but there is no explicit mention of environmental justice goals in this research. We see critical questions of environmental justice associated with this research and suggest partnering with other researchers within SHC to more directly address these issues including:

- Where do spill and leaks occur?
- What are the characteristics of populations exposed to oil spills and leaks from underground storage tanks?

When the answers to these questions indicate that exposed populations are in overburdened communities or create costly environmental inequities and disproportionate health and environment risks, these are environmental justice issues that must be addressed because of the costs they pose to the nation as a whole. By integrating environmental justice mapping with oil and fuels research, these goals can be more explicitly addressed through research.

The Subcommittee notes that meeting long term community sustainability and environmental justice goals likely requires research partnership with social scientists and others who can systematically assess community vulnerabilities, contextual differences, and needs. Geographers, with spatial modeling capacities can support models that differ in resolution and scales.

Recommendation: Project 3.2

Recommendation 2.3: Integrate social science and spatial modeling expertise into oil and fuel release research to identify disproportionately burdened communities and changing geographies of oil and fuel release hazards.

Project 3.63 – Sustainable Materials Management

Anticipating Future Problems: While current needs appear to be adequately addressed, the SHC's capacity to address future SMM research needs appears to be a work in progress. Several respondents noted very preliminary discussions about future challenges in SMM that will require scientific exploration (e.g., climate change mitigation and adaptation, and the globalization of materials trade in both material sourcing and waste streams). Both OLEM and SHC staff describe the need to better integrate climate change adaptation into current LCA and materials analysis tools and research priorities. For example, the work that was presented for management of wood waste related to extreme weather events is a great example of the kind of analysis that is needed. The next step would be to extend the approach to the unique waste streams from the built environment following extreme weather events. In addition, an example of an application of the HELP model to assess the impact of changing precipitation rates on landfill performance illustrated that some climate adaptation considerations are being made in the development of new tools, but adaptation did not appear to be the primary motivation that drove the development of that particular capability.

Addressing Long-Term Community Sustainability and Environmental Justice Goals: The work of SHC to advance the practice of LCA and integrate that perspective into tools and other resources is impressive and should be applauded for its comprehensive approach to climate mitigation considerations. However, because the LCA perspective is inherently not place-based, it can create conflict and misinterpretation of results from an environmental justice perspective where the physical distribution of impacts is a key consideration – potentially beyond U.S. borders. This would be of particular concern in the use of the Spreadsheets for Environmental Footprint Analysis (SEFA) tool.

The updated WARM LCA tool does a better job of identifying the individual processes responsible for increases or decreases in GHG emissions associated with different management options than previous versions of the tool. This visual depiction of impacts could be improved to better identify local versus non-local processes so that those nuances can be clearly communicated to the stakeholders of those practitioners using the tool. Similarly the work of advancing anaerobic digestion as part of Zero Waste community is of high quality and crucial for reducing GHGs. While the technology is certainly a potentially significant contributor to the national energy supply, there are still environmental justice concerns with the siting of those facilities related to the local air quality impacts they may exacerbate. Identifying those

upfront and communicating them to users of SHC developed outputs may help to avoid environmental justice conflicts. We encourage the continued investment in resources such as MWiz to ensure that the results of SHC's work are communicated and accessible by community level practitioners.

Conversations between the BOSC and poster presenters turned to the "human cost" of materials management, however this was not reflected in any of the research materials presented. Recognizing the impact of conflict minerals in electronics could help the development of markets to better recycle those materials. In addition, building a more circular economy will be an economic development effort. To the extent that the economic benefits of materials management jobs can be incorporated in the decision support tools produced by the program, communities could better weigh the tradeoffs between jobs and health impacts of siting an anaerobic digester, for example.

Recommendations: Project 3.3

Recommendation 2.1: Increase the frequency and quality of landscaping efforts by SHC researchers (i.e., published literature reviews, outreach to program and regional staff, and publication, conference, and policy tracking) to accurately reflect the state of SHC knowledge and periodically identify core future problems that will have SMM science implications.

Recommendation 2.2: Gather input regarding future SMM challenges and opportunity through relationships with OLEM, given their capacity to merge and prioritize research needs across Agency offices.

Recommendation 2.3: Use PACTs as an opportunity to identify long-term SMM trends as well as short-term research needs.

Charge Question 3. How are SHC Sustainable Approaches for Contaminated Sites and Materials projects, and associated research from other parts of SHC, helping communities achieve sustainability?

General Observations and Recommendations

Historically, EPA has developed regulations and worked through the regional offices to ensure that these programs are effective through delegation to the states. While US EPA has a history of working with local governments, states have historically had relationships with local communities. As ORD seeks to grow its program of tools and other technical support for sustainable and healthy communities, ORD should look for opportunities to insure that local community priorities are recognized in the ORD research planning process. ORD has begun to partner with existing networks of cities sustainability directors. Similarly, regional networks of sustainability directors may benefit from a closer relationship with the regional offices. EPA Region 1 is already well engaged with northeast City sustainability directors.

At the same time, ORD needs to be careful not to inadvertently interfere in the working relationships that the program offices within OLEM have with grantee communities (in the case of the Office of Brownfields and Land Revitalization [OBLR] and OUST) or superfund communities. Field testing tools and techniques is necessary, but test site selection should be careful to coordinate with the program and regional offices working with local communities so that ongoing projects are not compromised and tool successes or problems are not measured under abnormal conditions.

Data are largely unavailable to answer the question of how SHC projects and research are helping communities achieve sustainability, as are definitive metrics for the construct of sustainability. Research

outputs often do not have clear links to community outcomes. Even when looking at the quality of outputs, the BOSC SHC committee could barely find information on output metrics (e.g., bibliometrics, user feedback, use volume compared to other tools, etc.). In those cases where SHC demonstrations or pilots are conducted in specific geographic communities, there are more immediate outcomes that can be tracked, but these are small in number, anecdotal, and not reflective of the broader outcomes that are likely occurring from replication of SHC tools and findings and the application of SHC-produced knowledge.

To help communities achieve sustainability, SHC would benefit from more active efforts to obtain feedback from communities on the usefulness of its tools and products, beyond a website link that invites comments. Clear articulation of how SHC-driven work can support long-term capabilities of programs and regions could relieve the tension between competing priorities. In presenting the full scope of current and possible research, SHC can negotiate more effectively with partners on priorities given limited resources. Partner-driven research is still a core function and mission of SHC, and should not be jeopardized.

Recommendations

General Recommendation 3.1: Document formal assessments of partner needs in such a way that facilitates clear decision making around future prioritization so that those decisions can be communicated transparently.

General Recommendation 3.2: Document formal and informal engagement processes to solicit needs so that clear lines can be drawn between the problem formulation stage and the development of a research or tool development project.

General Recommendation 3.3: Evaluate ORD's scientific activity in line with those conducted for other Federal research organizations to provide preliminary evidence of SHC's contributions to community sustainability in general and to help SHC develop reliable and easily maintained tools for tracking outputs and, eventually, outcomes.

Summary List of Recommendations

General Recommendations

- **General Recommendation 1.1:** Follow the principles of community engagement (e.g., build relationships from the ground up versus top down) to build trust and ensure priorities are based on local issues and needs.
- **General Recommendation 1.2:** Engage communications and social science expertise to develop a set of metrics to gauge communication effectiveness as well as provide EPA program and regional staff with the tools for articulating actionable research agendas.
- **General Recommendation 3.1:** Document formal assessments of partner needs in such a way that facilitates clear decision making around future prioritization so that those decisions can be communicated transparently.
- **General Recommendation 3.2:** Document formal and informal engagement processes to solicit needs so that clear lines can be drawn between the problem formulation stage and the development of a research or tool development project.
- **General Recommendation 3.3:** Evaluate ORD's scientific activity in line with those conducted for other Federal research organizations to provide preliminary evidence of SHC's contributions to community sustainability in general and to help SHC develop reliable and easily maintained tools for tracking outputs and, eventually, outcomes.

Project 3.1: Contaminated Sites

- **Project 3.1 Recommendation 1.1:** Improve community engagement by informing Task 1 (providing technical support) with information from Task 5 (tools for evaluating spatio-temporal impacts of contaminated sites on the environment).
- **Project 3.1 Recommendation 1.2:** Increase opportunities for collaboration within ORD and with other federal agencies, such as the Centers for Disease Control and Prevention (CDC), the Department of Energy (DOE), the Department of Defense (DOD), the National Institute of Environmental Health Sciences (NIEHS), etc. in order to leverage research to advance the aims of site revitalization and urban regeneration.
- **Project 3.1 Recommendation 2.1:** Strengthen internal and external partnerships to leverage resources to address broader community sustainability and environmental justice research questions by incorporating community engagement expertise as well as social science expertise in economics, education, psychology, sociology, anthropology, health care and mental health, urban development and planning.
- **Project 3.1 Recommendation 2.2:** Develop predictive modeling tools that can be used to explore alternative futures and the implications of future demographic, economic, social, environmental, and urban trends to better understand and manage contaminated sites.

Project 3.2: Environmental Releases of Oils and Fuels

- **Project 3.2 Recommendation 1.1:** Facilitate feedback from state and local oil spill responders to assess utility of research in the field and to inform research on oil and dispersant behavior in real spill situations.
- **Project 3.2 Recommendation 1.2:** Incorporate more direct ways to respond to local community needs in the context of oil spills and leaking fuel tanks and to validate basic research in local settings.
- **Project 3.2 Recommendation 1.3:** Facilitate the exchange of information that would improve data quality on proximate water supplies to investigate interactions of groundwater sources and backlog LUST sites.
- **Project 3.2 Recommendation 2.1:** Expand research capacity to anticipate future changes in oil and fuel types as well as changing geographies associated with new extraction and transportation networks.
- **Project 3.2 Recommendation 2.2:** Prioritize the procurement of reference oils and fuels for testing.
- **Project 3.2 Recommendation 2.3:** Integrate social science and spatial modeling expertise into oil and fuel release research to identify disproportionately burdened communities and changing geographies of oil and fuel release hazards.

Project 3.3: Sustainable Materials Management

- **Project 3.3 Recommendation 1.1:** Formalize more opportunities for informal communications between OLEM and ORD's SHC staff to ensure longer-term input into SHC's research plans and responsiveness to research needs.
- **Project 3.3 Recommendation 1.2:** Increase efforts to survey the landscape of other SMM scholars, federal policy staff, practitioners and potential partners that work directly in communities as opposed to reaching communities indirectly through states.
- **Project 3.3 Recommendation 2.1:** Increase the frequency and quality of landscaping efforts by SHC researchers (i.e., published literature reviews, outreach to program and regional staff, and

publication, conference, and policy tracking) to accurately reflect the state of SHC knowledge and periodically identify core future problems that will have SMM science implications.

- **Project 3.3 Recommendation 2.2:** Gather input regarding future SMM challenges and opportunity through relationships with OLEM, given their capacity to merge and prioritize research needs across Agency offices.
- **Project 3.3 Recommendation 2.3:** Use PACTs as an opportunity to identify long-term SMM trends as well as short-term research needs.

CONCLUSIONS

The BOSC SHC Subcommittee reviewed materials provided in advance, as well as the applications presented in poster sessions and panel discussions, and other interactions at the Subcommittee meeting. As emphasized above, the overwhelming reaction of the Subcommittee is that the basic science being conducted on environmental toxins, pollutants, and sustainable materials management and how these can be mitigated or eliminated is noteworthy. Overall the BOSC SHC Subcommittee was very impressed by the quality of research that was presented in this regard.

The BOSC SHC Subcommittee recognizes the challenge in connecting the implications of the environmental science research on contaminated sites, oils and fuels, and sustainable materials management to broader community sustainability and environmental justice goals. The necessary level of integration requires understanding not only of the implications of basic science, but also of behavioral and social sciences (e.g., economic, social, cultural, and political factors), and the linkages between the human and environmental systems. Such applied dimensions investigate how the presence of environmental pollution and associated toxins, or sustainable materials management, affect the community, e.g., in terms of the environmental justice implications of remediation and how the impacts of environmental pollution translate into measures of individual and community well-being.

As emphasized in the Introduction, the charge questions presented to the BOSC SHC Subcommittee are oriented largely toward the applied dimensions of Topic 3 efforts, while much of the materials presented and discussed focused on the basic science elements. The Subcommittee agreed that Topic 3 research is important and relevant to environmental challenges faced by communities. The Subcommittee also recognizes the challenge in connecting the implications of the environmental science research on contaminated sites, oils and fuels, and sustainable materials management to broader community sustainability and environmental justice goals, given the bureaucratic nature of the organization and governance of research.

APPENDIX A: MEETING AGENDA

FINAL 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: <ul style="list-style-type: none"> 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)? <i>Goal: Speakers to help BOSC and other attendees understand pressing issues from a PO/RO perspective and how research connects to these.</i>	Stiven Foster, OLEM
1:40 – 2:00	Successful Partnerships: <ul style="list-style-type: none"> What are one or two examples of how ORD research or support assisted your program on oil and fuel related issues? <i>Goal: Build a narrative illustrating ORD interaction with other parts of Agency</i>	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	

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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: <ul style="list-style-type: none"> 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)? <i>Goal: Speakers to help BOSC and other attendees understand pressing issues from a PO/RO perspective and how research connects to these.</i>	Tim Taylor, OLEM
8:45 – 9:05	Successful Partnerships: <ul style="list-style-type: none"> What are one or two examples of how ORD research or support assisted in issues related to managing materials sustainably? <i>Goal: Build a narrative illustrating ORD interaction with other parts of Agency</i>	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

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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: <ul style="list-style-type: none"> 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)? <i>Goal: Speakers to help BOSC and other attendees understand pressing issues from a PO/RO perspective and how research connects to these.</i>	Dan Powell, OLEM
2:00 – 2:20	Successful Partnerships: <ul style="list-style-type: none"> What are one or two examples of how ORD research or support assisted in issues related to contaminated sites? <i>Goal: Build a narrative illustrating ORD interaction with other parts of Agency</i>	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

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4:45 – 5:15	BOSC Discussion: BOSC to share observations on posters, presentations, and partners panel discussions.	Mike Scozzafava, OLEM (via phone) 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.