

U.S. Environmental Protection Agency (EPA) Board of Scientific Counselors (BOSC)
Executive Committee (EC)
Face-to-Face Meeting Minutes
January 11–13, 2017

Date and Time: January 11, 2017, 9:00 a.m. to 6:00 p.m.; January 12, 2017, 8:30 a.m. to 5:15 p.m.; January 13, 2017, 8:30 a.m. to 1:00 p.m. Eastern Time

Location: EPA Research Triangle Park Research Facility, 109 TW Alexander Drive, Durham, North Carolina

Meeting Minutes

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Wednesday, January 11, 2017

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

Convene Meeting

Thomas Tracy, Designated Federal Officer (DFO)

Mr. Thomas Tracy, the DFO for the BOSC EC, formally opened the meeting and welcomed the EC members. He discussed the Federal Advisory Committee Act (FACA) stipulations governing the meeting, which require that the meeting is open to the public and that there must be time reserved for public comments. He thanked the members for their contributions and made brief announcements regarding the meeting space and housekeeping details. Mr. Tracy turned the meeting over to Dr. Deborah Swackhamer, the EC Chair.

Welcome

Thomas Burke, Deputy Assistant Administrator and Robert Kavlock, Deputy Assistant Administrator for Science

Dr. Swackhamer welcomed the EC members and EPA staff. She then introduced Dr. Thomas Burke, the EPA Science Advisor and Deputy Assistant Administrator at the Office of Research and Development (ORD), and invited him to make his introductory remarks.

Dr. Burke reflected on the fact that the end of his tenure as Science Advisor was drawing near. He noted the important role ORD plays in driving science forward. He said that the BOSC helps EPA think through the complicated science issues and determine ways to integrate the Agency's work. Dr. Burke commented that BOSC provides a lifeline between the Agency and the broader community and added that the EC has never been more important to EPA or the field in general. Decision making relies on the underlying science, and BOSC ensures that EPA science is of the highest quality.

Dr. Burke introduced Dr. Robert Kavlock, the Deputy Assistant Administrator for Science at ORD.

Dr. Kavlock highlighted several ORD staffing changes. He stated that Dr. Burke's last day would be Tuesday, January 17, 2017 and that he will serve as the Acting Science Advisor and Acting Assistant Administrator for ORD effective January 20, 2017. Dr. Bruce Rodan will replace Dr. Kavlock as the Deputy Assistant Administrator for Science. Dr. Lek Kadeli departed the Agency for a two-year detail at the World Bank, and Mr. Chris Robbins will serve as the Associate Assistant Administrator for ORD and the Deputy Assistant Administrator for Management for ORD. Dr. Kavlock also announced that Dr. Tina Bahadori took over as Director of the National Center for Environmental Assessment (NCEA), replacing Dr. Mike Slimak, who had been serving as Acting Director since August 2016. Stepping in for Dr. Bahadori, Dr. Jeff Frithsen is serving as Acting National Program Director (NPD) for the Chemical Safety for Sustainability (CSS) Research Program. Dr. Elaine Cohen Hubal will serve as the Deputy NPD for CSS, replacing Dr. John Cowden, who will return to the National Center for Computational Toxicology (NCCT) after serving as the Acting Deputy NPD for CSS. Dr. Brian Hubbell will serve as a Senior Advisor on social science with the Air, Climate and Energy (ACE) Research Program.

Dr. Kavlock thanked the EC members for the draft reviews, and encouraged them to highlight the most important recommendations in their final documents, as it will help ORD determine how best to move forward.

Introduction of BOSC Members EPA Staff

Deborah Swackhamer, Chair

Dr. Swackhamer thanked Dr. Burke, Dr. Kavlock, and Mr. Tracy for their remarks. She briefly reviewed the agenda and the meeting process. Dr. Swackhamer noted the goal of the meeting was to ensure the draft reports are as fine-tuned and useful to ORD as possible.

Dr. Swackhamer asked the EC members and EPA staff to introduce themselves. Please see Appendix B for the full list of meeting attendees.

Public Comments

Registered Speakers

Dr. Swackhamer asked for public comments, and there were none.

Presentation of Draft Report on Environmental Justice Annual Report

Courtney Flint

Dr. Courtney Flint presented the draft review of the Environmental Justice (EJ) Roadmap Annual Report. She noted the EJ Roadmap was extensively edited throughout the past year and presents a comprehensive approach to addressing environmental health inequalities. She noted that the EJ BOSC workgroup was impressed with the efforts made by Dr. Andrew Geller's team to revise the document.

Dr. Flint reviewed the charge questions for the EJ Roadmap Annual Report (see Appendix C for the full list). She stated that overall the EJ Roadmap Annual Report focused on the progress and accomplishments from fiscal year (FY) 2015–2016. She anticipated an even stronger trajectory in coming years, assuming ORD maintains resources to support EJ.

She discussed the recommendations associated with Charge Question 1. Regarding the levels of commitment to Roadmap recommendations, Dr. Flint expressed that the Annual Report demonstrated an impressive array of EJ research efforts, but provided little information about actual research findings and accomplishments. She stated that the workgroup could clearly identify the outputs, but it was difficult to determine their impact. Recommendation 1 suggests that future Annual Reports summarize specific and representative research findings that are responsive to the key science questions posed in the EJ Roadmap.

In terms of coordination across EPA's National Research Programs (NRPs), Dr. Flint stated that Annual Report showed strong commitment to EJ across ORD endeavors, largely through the Science to Achieve Results (STAR) grant program. However, the Annual Report included few details about whether and how coordination had occurred across the programs. Recommendation 2 states that future Annual Reports should include information about coordinating EJ research efforts across NRPs. She explained that Recommendation 3 encourages the use the final EJ Roadmap as a guide and recommends conducting a synthetic review of extramural and intramural efforts to identify gaps or under-emphasized areas that might be targets for future requests of applications (RFAs).

Dr. Flint stated that it was unclear how the projects listed in Appendix E of the Annual Report relate to EJ and recommended including relevant details. She noted that many reported efforts

produced decision support tools, training efforts, and other efforts to provide information and encourage collaboration, which underscores the need to enhance information access. Therefore, Recommendation 6 encourages all ORD efforts focused on EJ issues to emphasize multi-faceted communication and outreach components that recognize procedural justice, recognitional justice, and justice of capabilities dimensions of EJ to ensure research information reaches communities in ways that match their varying needs and capacities.

Regarding areas of innovation, Dr. Flint stated that the “Addressing Emerging Issues” section demonstrates a commitment to the environmental health needs of overburdened communities. She noted that the workgroup recommends that ORD maintain the resources and capacity necessary to respond quickly in the face of emergent issues in overburdened communities, underscoring that those who are most overburdened are often the least able to respond.

Dr. Flint then discussed the recommendations associated with Charge Question 2. She noted multiple individual and societal aspects that, in addition to race, are increasingly viewed as important in the field of EJ research, including indigeneity, gender, rural-urban difference, age, and employment status. The workgroup made two related recommendations. First, ORD should expand EJ research to investigate the intersectionality of socio-demographic and spatial factors leading to inequities in environmental risk and overburdened communities. Second, ORD should continue to focus on codifying best measurement practices to address complexity in EJ research.

Dr. Flint stated that the “Looking Ahead” sections of the Annual Report showed commitment to providing decision support tools. The workgroup suggested that ORD maintain or enhance resources and research capacity to address the objectives and gaps identified in the final EJ Roadmap. The final recommendation was to ensure that new ORD decision support tools to address those objectives are not only developed, but also disseminated to those who need them most.

Dr. Flint closed by stating that the workgroup was impressed with the ORD’s EJ work.

Environmental Justice Roadmap Lead Comments

Andrew Geller, EJ Roadmap Lead

Dr. Geller voiced his appreciation of BOSC’s helpful feedback on the EJ Roadmap during the November 2016 teleconference and stated that his team made the relevant edits in response to their discussion. First, he edited the EJ Roadmap to include a discussion of “just sustainabilities,” as defined by Agyeman et al. (2003) as “Ensuring a better quality of life for all, as defined in different community contexts, in a just and equitable manner, while living within the limits of supporting ecosystems.” Dr. Geller explained that, with an emphasis on well-being, environmental quality, and equity, this definition truly captures the Agency’s mission. He noted the importance that the definition of sustainability is nested in a vital, resilient economy of a healthy, equitable society that exists within the limits imposed by its supporting ecosystems.

Recognizing BOSC’s comments on issues of gender, rural-urban, and other differences in addition to race and income, Dr. Geller stated that he edited the EJ Roadmap to include additional science questions in the gap analysis discussion of environmental health disparities. Specifically, the new questions are: “What part do factors such as age, gender, and urban vs. rural play in environmental health disparities? How do empowerment issues intersect with demographics and other spatial aspects of exposure?”

With respect to BOSC’s review of the EJ Roadmap Annual Report, Dr. Geller noted that the comments centered around three main themes: (1) effective research communication and translation between the Agency and external EJ stakeholders; (2) responsiveness to Agency and external EJ stakeholder needs related to EJ (e.g., science tools, information, decision support etc.); and (3) identifying and addressing gaps in ORD’s research enterprise through a social science lens.

Dr. Geller stated the need for increased emphasis on communication of research findings and research translation to the public using lay language materials. He stated that the revised Annual Report will highlight the Making a Visible Difference, Regional Applied Research Efforts (RARE), and Regional Sustainable Environmental Science work, which will focus on using case studies and quotable examples. Dr. Geller also underscored the importance of reporting the progress of EJ research together with its impact. Dr. Geller commented on the open “update” meetings between Agency researchers and the EJ community stakeholders as well as the development of a robust inventory of ORD’s EJ-related research.

In terms of ORD’s responsiveness to Agency and external EJ stakeholder needs, Dr. Geller explained that the Annual Report will discuss trainings for Regional staff on the use of Agency tools to identify and address EJ concerns related to community-based participatory research and citizen-science.

To identify and address the gaps in ORD’s EJ research, Dr. Geller noted ORD will organize an EJ workgroup and continue coordination efforts with the Office of Environmental Justice on EJ 2020. He agreed with the BOSC’s suggestion to use the EJ Roadmap to identify gaps or underemphasized areas in extramural and intramural efforts and using this information to guide future RFAs.

Discussion of Draft Report on Environmental Justice Annual Report

Deborah Swackhamer, Chair

Dr. Swackhamer explained that the EC’s goal was to assemble one overarching report and reiterated that the members needed to be in agreement on the content. She reminded the members that ultimately all subcommittee reports would be formatted and examined for editorial clarity. She opened up for comments and questions for Dr. Flint and Dr. Geller.

Dr. Paula Olsiewski asked for clarification on whether the subcommittees should leave in recommendations if ORD had taken action since the subcommittee made their recommendation. Dr. Swackhamer replied that for accountability and as a process for documenting their evolution, all recommendations should remain in the Draft Reports.

Dr. Leslie Rubin commented that the EJ Roadmap should increase its focus on children, the most vulnerable population. Dr. Swackhamer agreed and noted that the Children’s Environmental Health (CEH) Annual Report discusses EJ, but children’s health is not mentioned in EJ Annual Report.

Dr. Swackhamer asked whether Recommendation 4 refers to the STAR grants or extramural funding. Dr. Geller clarified the difference between extramural funding and extramural research. Dr. Flint stated she will review the language, add the definition of extramural research, and make the language consistent.

Dr. Swackhamer noted Recommendation 10 might not fall under the jurisdiction of EPA. She added that, although it is a good statement in the text, it is not be actionable. Dr. Flint agreed to eliminate the recommendation and move the relevant language to the main text.

Dr. Swackhamer asked for feedback on the priority of the recommendations. Dr. Olsiewski suggested that the recommendations could be categorized as relating to technical content and reporting. Dr. Flint explained that although some recommendations are combined, some are interrelated and embedded in the mechanistic piece. Dr. Swackhamer asked each writer to make the recommendations actionable to ORD, citing Recommendations 1 and 2 as examples.

Ms. Sandra Smith requested clarification of the definitions of the EJ Annual Report, stated in Recommendation 6, and suggested including a footnote to guide translation, specifically of the three kinds of EJ justice. Dr. Kavlock expressed that these first reports written by ORD serve as prototypes. The BOSC should consider the audience and whether they should be technical or in layperson terms.

Related, Dr. Ponisseril Somasundaran raised the issue of acronym use. Dr. Rubin noted that writing in layperson terms would increase awareness of the Agency's value and research. Ms. Smith endorsed Dr. Rubin's statement, and remarked the reports could be used as an effective tool within the CEH workgroup. Dr. Swackhamer clarified that the audience for the subcommittee reports was the NPD and the audience for the Annual Reports was difficult to pinpoint. She requested the NPDs clarify their audience when writing the Annual Reports.

Dr. Geller explained the EJ Annual Report was written as a tool for accountability purposes and did not intend it to be a comprehensive report or an annual communication report. Dr. Swackhamer restated that the Annual Report should be technical. Dr. Anne Rea agreed that to highlight the science and demonstrate the impact the reports should be technical. She added that they are also public documents, so the audience might be both lay and technical. Dr. Swackhamer stated that the BOSC prefers a technical report, and though it is a public document, it does not need to be completely "translated" for all audiences. Dr. Rea confirmed that as her approach. Dr. Miller added that the Climate Change Annual Report was written for internal use and did not take a "lay approach." Dr. Cowden stated that the CSS report was written exclusively the BOSC. Dr. Swackhamer stressed the importance of the documenting the impacts as well as capturing integration opportunities.

Dr. Swackhamer summarized the BOSC's recommendations regarding the EJ Annual Report, which include:

- Adding language related to children's health.
- Clarifying extramural research.
- Organizing and fine tuning recommendations.
- Clarifying the dense language in Recommendation 6.

Presentation of Draft Report on Children's Environmental Health Annual Report

Gina Solomon

Dr. Solomon explained the workgroup's process and thanked Dr. Olsiewski, Dr. Rubin, and Ms. Smith for their contributions.

Dr. Solomon commented that the CEH Annual Report reflected great progress on the CEH Roadmap over the past 18 months. Dr. Solomon explained that the workgroup was impressed by the impactful research, strong internal and external coordination, and outreach efforts.

Dr. Solomon commented that the workgroup was concerned by how technical the CEH Annual Report was, and added that it would not be accessible all audiences. She noted jargon that was not well-defined and, further, suggested creating a layperson summary of the Annual Report that would be helpful for the interested public. The workgroup also suggested that the accomplishments sections follow a more consistent format, as each section was written differently.

Dr. Solomon presented the nine recommendations from the workgroup. Dr. Solomon began by reviewing the workgroup responses to Charge Question 1, which contained three subsections. Related to subsection 1, which addressed the coordination across ORD's six NRPs, Dr. Solomon explained that the BOSC workgroup found that the CEH Implementation Working Group (IWG) provided a good focal point for coordination across the NRPs, but it was not clear whether all six research programs and three other crosscutting research areas were represented on the IWG.

Dr. Solomon addressed the next component of Charge Question 1, which addressed communication and outreach to partners and stakeholders. She noted the large number of publications in this area. The workgroup's first recommendation was to continue disseminating this work in the scientific community, which will require staff to travel and effort to be allocated toward publications and presentations. Second, the workgroup recommended communicating to a general audience and advised tailoring presentations and publications to the layperson. Third, the workgroup recommended partnering across federal agencies (e.g., the Centers for Disease Control and Prevention [CDC], National Institutes of Health [NIH]), and with the Pediatric Environmental Health Specialty Units (PEHSUs) and the American Academy of Pediatrics.

Dr. Solomon presented the recommendations related to areas of innovation. She underscored the critical importance of the Pathfinder Innovation Projects (PIPs) program, Smart Acceleration of Research Through Investment Awards program, and STAR Grants for encouraging innovation and driving forward cutting-edge research. She noted the Virtual Tissues Modeling and indoor air quality work as further evidence of innovation, acknowledging that the air pollution work is not new, but the integration underway in the area was worth highlighting as a new development. Dr. Solomon observed that the purpose of having seven separate current school STAR grant projects was unclear as written and suggested clarifying the justification for these projects so the lay reader could understand their purpose.

Dr. Solomon continued by addressing the topics under Charge Question 2. Related to identifying additional opportunities for implementation or integration not highlighted in the report, the workgroup suggested adding further discussion and additional examples related to the incorporation of social sciences in the FY17 Annual Report. Second, the workgroup recommended adding more explicit links with the EJ and Climate Change Roadmaps, as there is great potential for integration. Next, the workgroup proposed exploring greater integration and research focused on the evaluation of cumulative exposures, both chemical and non-chemical. Dr. Solomon added that this research should include the impacts of poverty and non-chemical stressors, in combination with chemical and environmental stressors on children's health. Lastly, Dr. Solomon commented that the Annual Report did not discuss how ORD identifies and

evaluates emerging issues. She suggested that a brief discussion of the process would add to the narrative on the ongoing implementation of the CEH Roadmap.

The CEH Annual Reports' The Year Ahead section adequately described the next steps and short-term research areas and commitment, but Dr. Solomon noted the Progress and Emerging Opportunities sections in the executive summary and The Year Ahead section in the body of the report were scanty and vague. She did not think they conveyed energy or excitement. The workgroup recommended the ORD provide more details related to the on ongoing and planned research activities for the coming year.

Dr. Rubin commented that an emerging area of concern within CEH is prenatal exposures and stressed that it should be an emerging area explored in the future. Dr. Bahadori agreed with Dr. Rubin on the importance of this issue, but added that there is much work related to pre- and perinatal exposures in the CSS program. Dr. Swackhamer added that the links between the CSS program and the Children's Health Roadmap should be clarified. Dr. Solomon agreed with Dr. Bahadori, and commented that the issue of prenatal development was well covered in the Annual Report, referencing discussions on vascular genesis, prenatal exposures, Zika virus, and prenatal neurotoxicity. Dr. Solomon underscored the importance of continuing this work.

Children's Environmental Health Roadmap Lead Comments

John Cowden, CEH Roadmap Lead

Dr. John Cowden explained his three areas of concern related to the BOSC's comments. First, he discussed the issue of the technical nature of the CEH Annual Report. The authors concluded that the audience was the BOSC, not a lay reader, and the goal was to provide a high level summary. Though he acknowledged that the CEH Annual Report was potentially too technical, Dr. Cowden commented that making CEH research available is an important goal for the CEH IWG. He explained that one of the major goals of the cross-program IWG was to organize a monthly CEH meeting to draft a report that will be continually updated online. He added that they also discussed a children's health fair.

Next, Dr. Cowden discussed the topic of integration. He explained that the CEH Roadmap and Annual Report are in their first full year and have, thus far, focused internally. Dr. Cowden reiterated the successes of the IWG and added that ORD has also established Partner Action Committee Teams (PACTs). The topics of the PACTs might be related to CEH and it was likely that participants involved in the IWG were also participating in the PACTs. Therefore, the PACTs serve as an integration nexus that can improve communication across the NRPs.

Dr. Cowden continued by discussing the integration of social science. He explained that in FY16 ORD held a Social Science 101 seminar with Dr. Flint and Dr. Richardson. He mentioned that one of the challenges facing the integration of social science is its local, context-dependent nature, noting EPA's national regulatory context as a potentially complicating factor. The seminar therefore opted to use case studies to identify lessons learned and how to apply certain approaches across ORD science.

Finally, Dr. Cowden discussed the identification of emerging areas of concern. He explained that they are typically identified organically through discussions at numerous levels of the Agency. He agreed that a formalized and integrated approach would make be better.

Dr. Swackhamer asked Dr. Cowden if he was concerned with any of the suggestions related to expanding the cross-agency collaboration with NIH, CDC, or the PEHSUs. Dr. Cowden replied ORD engages with the PEHSUs and partners with other federal agencies to fund them.

Discussion of Draft Report on Children’s Environmental Health Annual Report

Deborah Swackhamer, Chair

Dr. Viney Aneja asked Dr. Cowden if he preferred the recommendations be categorized in a specific way. Dr. Cowden responded that categories are easier to respond to and prioritized recommendations would be helpful as resources decrease.

Dr. Swackhamer noted the importance of several of the recommendations, specifically those related to integration and emerging concerns. She added all recommendations should be actionable and specific.

Dr. Somasundaran raised concern about the line on page 4 of the BOSC’s draft review of the CEH Annual Report: “Indoor air quality has been an issue of concern for decades, so it is important not to portray it as a new issue.” He mentioned recent research publications had explored new issues in indoor air quality, such as exposure to nanoparticles used in tablets and smartphones. He also noted that the United Nations and the World Health Organization could be included in the list of potential partner agencies, as they consider the effect of natural disasters and other impacts on children.

Dr. Flint commented that the Agency has processes and procedures that affect the speed at which work is done and recommendations could be implemented. She noted that the EC members should be sensitive to this as they wrote their recommendations, and Dr. Swackhamer agreed.

Dr. Rubin clarified that EPA does fund the PEHSUs, but the PEHSUs cannot conduct research, which was why the partnership is important. EPA performs the research, PEHSUs translate the work to health professionals and the public, and the PEHSUs identify and deliver concerns to the Agency. He noted the need to gather EPA researchers and PEHSU staff in a forum where there could be joint presentations and discussions. Dr. Swackhamer replied that the document should be revised to reflect Dr. Rubin’s comments.

Dr. Flint raised the importance of recognizing context-dependency and the case study approach, documenting those details for accountability, and synthesizing information to conduct meta-analyses. Dr. Flint recognized that this might not be generally applicable to all of the EC reports.

Dr. Rubin commented he would like to see prenatal exposures receive distinct attention in the EC review of the CEH Annual Report.

Dr. Kavlock clarified the ORD process for prioritization and emerging issues, i.e., its “elevation policy.” First, staff in the field can elevate an issue to ORD’s Executive Council. Alternatively, the President or Administrator can also determine priority issues, as was the case with Gold King Mine, Flint, and tire crumbs. He acknowledged the issue of trade-offs when new priorities are identified.

Dr. Swackhamer summarized the BOSC’s recommendations regarding the CEH Annual Report, which include:

- Acknowledge crossover and collaboration with CSS and fetal exposures.
- Add a response for the first bullet under the first charge question (inadvertently dropped).

- Clarify discussion of PEHSUs based on Dr. Rubin’s comments.
- Indicate the priority of the recommendations.

Presentation of Draft Report on Climate Change Annual Report

Robert Richardson

Dr. Richardson noted the Climate Change Annual Report had increased alignment with the Strategic Research Action Plans (StRAPs) and NRPs and clear evidence of collaboration across research programs and regional offices. The Annual Report demonstrated commitment to supporting coordination across climate-related research programs. The workgroup encouraged pursuit of extramural funding of climate-related research across the NRPs. In terms of programs like STAR, Dr. Richardson requested clarification because the workgroup did not locate references in the Annual Report.

The workgroup commended the continued communication and outreach efforts across ORD. He cited the PACTs as an example of efforts to increase communication and sharing of expertise. On coordination, the workgroup noted active engagement in ORD for providing information across the Agency regarding climate-related issues and research problems. Regarding areas of innovation, Dr. Richardson explained the workgroup observed efforts to seek public and community input to identify climate-related issues and develop innovations and solutions. He noted the workgroup thought that citizen-science engagement was noteworthy.

Dr. Richardson reviewed the recommendations and clarified the workgroup’s recommendations were not substantial, and there was great progress in revising the Roadmap.

Climate Change Roadmap Lead Comments

Andy Miller, Climate Change Roadmap Lead

Dr. Andy Miller stated the Climate Change Roadmap team appreciated the BOSC’s input on the Roadmap and the Annual Report and thanked Dr. Chris Weaver for creating the new narrative.

Regarding Recommendation 1, Dr. Miller asked what specific action the BOSC would like to see. Related to Recommendation 2, he clarified that the document discussed the STAR program. Dr. Miller explained the ACE centers are part of the STAR program, and the team will be more explicit that they are extramural research centers. For Recommendation 3, Dr. Miller clarified that integration activities are ongoing. He noted there are resource issues that limit the group’s ability to work across the program to focus on climate change

More generally, Dr. Miller raised questions about how the document could more effectively articulate integration activities and asked for feedback on increasing the focus on research products and impacts.

Finally, Dr. Miller stressed the importance of incorporating metrics into the Roadmaps although he acknowledged that synthesizing and incorporating case studies was beyond the scope of the current review.

Discussion of Draft Report on Climate Change Annual Report

Deborah Swackhamer, Chair

Dr. Richardson noted part of the BOSC’s draft report on the Climate Change Annual Report reflected a lack of understanding of how the Roadmap is funded. He suggested keeping the language, as it clarified how resources are allocated. Dr. Richardson commented that the climate

change workgroup should reflect on the phrasing and specificity of Recommendation 1. Dr. Shahid Chaudhry clarified that the comments were based on the information available to the group and acknowledged that a lack of information does not necessarily mean integration is not occurring.

Dr. Swackhamer commented that the text seemed acceptable, but the first recommendation could be moved to the text, as it did not seem actionable. The second recommendation also belonged in the text and required rewording to encourage the direction of STAR resources to all six national programs to improve climate change. She suggested that the third recommendation could be expanded, but it is appropriate. Dr. Swackhamer was unsure if the verb tense in the statement “the Partner Alliance and Coordination Team (PACT) meetings would be helpful,” was accurate under “Coordination and Outreach.” Dr. Swackhamer explained that she took “continuous” literally under “Next Steps and Short Term Research Areas and Commitment,” and suggested using “frequent” instead.

Within the Recommendations section, Dr. Swackhamer inquired about the meaning of the sentence “the magnitude and scope of research effort may be worth considering, given limited resources,” and whether it meant the scope was too broad, or that it could not be accomplished with the existing budget. Dr. Richardson responded the sentence referenced “given limited resources,” and that it was not a criticism. He added that it is not “too broad,” just “inherently broad,” and Dr. Swackhamer suggested text that captures “Be mindful of becoming too broad.”

Dr. Miller recommended putting the previous statement in the context of the Roadmap because the scope was addressed there extensively. Dr. Flint asked for clarification on whether their reviews were intended to be on the Annual Report, as she observed the groups’ comments. In terms of the scope and content the group was commenting on, she found some of the missing or unclear content from the Roadmap in the Annual Report. She added she has specific notes for improvements while reviewing the Roadmap as well.

Dr. Swackhamer explained that the EC was setting precedent with each conversation and advised keeping notes or recommendations regarding the Roadmap. The intention was to apply the charge questions to the Annual Report, but due to the recommended next steps, she advised the EC to offer their best judgement as it relates to the Roadmap as well.

Dr. Flint mentioned climate issues are multi-scalar, noting that at each scale there are different focal points. She explained that scale might be a way to structure the focal areas to avoid mismatches. Referring to the synthesis and meta-analysis, she further commented that documentation was critical to itemize the data, and synthesis is the next step.

Dr. Miller clarified that they have worked to move the program to the point where synthesis and evaluation will be the final step. He noted this was suggested in the Roadmap. Dr. Flint responded it could be summative, and it should be reported.

When discussing climate change, Dr. Rubin explained it is stated as one issue, but he divided it into aspects related to cause and prevention as well as effects and mitigation. Dr. Swackhamer responded that she would steer Dr. Rubin to the Roadmap, which she believed addresses that distinction. She commended the current Roadmap for finding EPA’s niche and adding value on how to mitigate, evaluate, and adapt to climate change.

Dr. Richardson explained that the workgroup did not have much to recommend, because the Roadmap had improved greatly. Dr. Kavlock added that only the Annual Report would be revised on a yearly basis.

Draft Report on Nitrogen and Co-pollutant Annual Report

James Galloway

Dr. James Galloway presented the comments to the draft report on the Nitrogen and Co-pollutant Annual Report on behalf of the BOSC Nitrogen (N) and Co-pollutant workgroup. He stated that the management of nitrogen to provide societal benefit without problems is a wicked problem, and the additional consideration of phosphorus (P), sulfur (S), and other nutrients made it an especially challenging problem. He noted the N and Co-pollutant workgroup recognized this challenge, had made great progress in 2016, and had commendable plans for 2017. He acknowledged the other members of the workgroup including Dr. Aneja, Dr. Somasundaran, and Dr. Tammy Taylor for their effort.

Dr. Galloway stated that the N and Co-pollutant Research Roadmap was created in response to the Agency's Science Advisory Board (SAB) Integrated Nitrogen Committee recommendations. He listed the N and Co-pollutant workgroup's three general recommendations including the use of the nitrogen cycle as an essential framework to address the environmental loading of reactive nitrogen (Nr), an integrated cross-media approach to more effectively manage reactive nitrogen, and monitoring and research to support management of reactive nitrogen. Dr. Galloway explained that following the workgroup's report, co-pollutants (e.g., P, S, sediments) were added.

Dr. Galloway reviewed the workgroup's charge questions (see Appendix C for the full list). He noted that the workgroup missed a charge question regarding the levels of commitment to Roadmap recommendations as appropriations in the StRAP. Dr. Galloway stated there was a high level of commitment and the Annual Report would be updated to include this.

Dr. Galloway stated the coordination across ORD's six NRPs was excellent in regards to successful integration and implementation as articulated in the Roadmap. The areas of integration, such as the One Biosphere Modeling Project, was impressive, as were the two 2016 Roadmap products. He highlighted the excellence of the example projects detailed in the Ongoing Activities Across Research Programs section. The challenges were well summarized, pointed to specific needs, and appeared to be achievable.

He discussed that the increasing population had potential to increase reactive nitrogen in the environment, but inventory and management remained a problem. With respect to N and P, food is the driver, so continued partnership with U.S. Department of Agriculture (USDA) will be critical, and Dr. Galloway suggested a targeted opportunity on related research. With respect to the Agency's contribution to N pollution issues, more social scientists would help engage the community they are trying to serve to increase effective communication to the public.

With regard to additional opportunities for implementation or integration not highlighted in the Annual Report, Dr. Galloway recommended exploring sustainability-related issues (e.g., air, water, and soil) related to Nr. He noted two case studies discussed in the document were both related to water bodies and the document could be enhanced considerably if there were a case study related to the atmosphere.

In the Year Ahead section, Dr. Galloway explained both the webinar to introduce research gaps and needs and the research integration summit (2016–2019) were favorable ideas. He also suggested continued joint workshops and participation by other federal partners (e.g., USDA, U.S. Geological Survey [USGS]).

Dr. Galloway mentioned that the FY16 N & Co-pollutant Roadmap Annual Report was impressive in its breadth, depth, and “wickedness” of the N problem. He noted, however, that much remained to be done, and the plans outlined for FY17 were promising.

Nitrogen and Co-pollutant Roadmap Lead Comments

Anne Rea, N and Co-pollutant Roadmap Lead

Dr. Rea thanked the BOSC for their thorough review. In looking at the review of the N and Co-pollutant Roadmap, it was focused heavily on water versus the atmosphere. She discussed the integration of N with P, S, and sediments and noted ORD is preparing a national Nr inventory that includes nitrous oxide (N₂O) emissions that will be integrated with the P inventory. She noted that the Agency was also thinking about adding S and other co-pollutants. The Safe and Sustainable Water Resources (SSWR) and ACE Research Programs have integrated sediment modeling for coastal and inland watersheds, and were testing satellite algorithms for detection of total light attenuating particles. In terms of N₂O research, Dr. Rea stated ORD participates in research on soil N₂O fluxes and soil emissions of N₂O from biofuel crops. She presented a map of the difference between total N deposition in 2002 (modeled) and 2022 (projected) that highlighted the importance of unmitigated agricultural sources of Nr, which would likely increase.

Dr. Rea stated the importance of ammonia (NH₃) in the ACE program. Within the ACE program, there was continued progress in measurement and modeling of NH₃ bidirectional exchange, including new advanced open-path techniques for direct flux measurements and development of low-cost techniques for routine NH₃ monitoring. There is a RARE project within the upcoming year and a Best Management Practices report on animal feeding operations NH₃ emissions, which was a joint effort with USDA.

Dr. Rea commented on the need for additional involvement with social scientists and primary economists and cited examples of related efforts across the ORD research portfolios. ORD currently has economic models for the water-energy nexus in the ACE program, SSWR is researching the cost of drinking water treatment, and the Sustainable and Healthy Communities (SHC) program investigates the damage costs related to Nr. She also highlighted SHC’s life-cycle-related paper on N product input-output in the Midwest and how SHC/SSWR coordinates with the Life Cycle Assessment Center of Excellence on carbon, N, and P emission factors. She also noted a SHC/SSWR effort to partner with EPA communications staff on sharing diet and other N footprint-related work with the general public to inform food habits through social sciences and social media.

Dr. Rea stressed the importance of continued federal partnerships. She stated that in March 2017, ORD would host a nutrient roundtable jointly organized by EPA, USDA and the U.S. Forest Service (USFS). The goal is to create a white paper that captures the community’s perspectives on the major obstacles to improving atmospheric deposition and water quality monitoring for N and P, as well as to provide strategies to overcome those obstacles.

A critical load mapper tool would be available February 2017, which is a joint effort with the U.S. National Park Service (NPS), USFS, and ORD. Dr. Rea then highlighted that the Agency and USGS would be launching a nutrient sensor challenge to deploy water sensors in real-world environments. An International Nitrogen Initiative’s North American case study in Puget Sound would be a joint effort between USGS, EPA ORD and Region 10, NPS, the National Oceanic and Atmospheric Administration, USDA National Resources Conservation Service, Environment Climate Change Canada, Agriculture and Agri-Food Canada, and a host of state and local agencies. It would be an ongoing effort to write proposals and develop fact sheets to build local stakeholder support.

Dr. Rea inquired about the overall assessment of the Annual Report, specifically if there was a better way to organize the document given its multi-media focus. She also asked, in terms of applying the recommendations, if ORD should revise the FY16 Annual Report or apply the recommendations to the FY17 Annual Report. She also requested clarification on the comment regarding the “integration of N with P, S and sediments.” Finally, she thanked the BOSC for their thoughtful review and continued support.

Discussion of Draft Report on Nitrogen and Co-pollutant Annual Report

Deborah Swackhamer, Chair

Dr. Galloway stated the overall assessment could demonstrate balance to showcase the work with air, but there was no need to revise the FY16 Annual Report, but rather apply the comment to the FY17 version. He also suggested further discussion of the integration of N-P and N-S together. Dr. Swackhamer asked about the integration of co-pollutants when they co-vary from sources and do not behave the same. She suggested adding text to clarify. Dr. Galloway confirmed that if they are separated by matrix type, it would be easier.

Dr. Rea sought clarification regarding food, water, and energy and whether it should follow the N-cascade. Dr. Galloway also suggested the P-cascade, and pointed to a recent paper published by Dr. Graham McDonald to merge the two. Dr. Rea stated that she will provide written responses to the BOSC comments, rather than revise the reports. Dr. Swackhamer asked if on page 2, “Areas of Innovation,” items 1, 2, and 3 should be italicized, and Dr. Galloway confirmed. She also requested recommendations be more readily identified using bold text.

Dr. Flint recommended the integration of metals be added to the next report, and also that particular consideration be given to existing and ongoing social science regarding the water, and N issue. She proposed the BOSC carefully consider its recommendations pertaining to the integration of social science and partnerships that could be made with ongoing work. Dr. Galloway agreed and stated the report should reflect the integration of existing social science research.

Dr. Rea commented on the inclusion of metals as a co-pollutant. Her program struggled on what to include under the term “co-pollutants.” Dr. Kavlock explained that they should limit their scope to nutrient effects.

Dr. Richardson stated that social science could be used to influence food habits pertaining to both consumption and production. Dr. Galloway asked for some alternative language regarding the influence coming from people versus the land.

Dr. Swackhamer requested clarification on food influences and inquired what was meant by the use of social media. Dr. Galloway explained the mission to engage the farmer and discuss the

supply chain. Dr. Swackhamer suggested the workgroup be more specific if the recommendation is to use social media to influence the public

Dr. Richardson and Dr. Flint examined interactions of the actors in the system and recommended broadening the recommendation to point to an area of study to address social sciences (e.g., examine farmer habits versus food consumption). Dr. Rea mentioned that ORD had a task in the SSWR portfolio to understand why farmers make their choices, but without any social scientists on board to address the topic, it might be cut. Dr. Flint and Dr. Swackhamer stated that this research has already been conducted and just needs to be integrated.

Dr. Swackhamer summarized the changes to the BOSC's draft review of the draft N and Co-pollutant Annual Report:

- Add in a response to the missing bullet under Charge Question 1.
- Identify the recommendations as opposed to observations.
- Revise the social science recommendations by working with Dr. Richardson and Dr. Flint on the social science bullet.

Dr. Swackhamer addressed the formatting and integration of the Roadmaps and encouraged each group to focus on the key recommendations for each research program to prioritize the BOSC's recommendations for the Agency. She suggested each workgroup read the Annual Reports and prioritize recommendations that are possible within the timeframe of a year and make each recommendation actionable.

Presentation on Program Evaluation and Metrics

Monica Linnenbrink, ORD

Ms. Monica Linnenbrink, ORD Communications and Outreach Team, provided an overview of ORD's work related to research program metrics. She explained that the Agency had taken a hybrid approach and used several categories of metrics and considered the National Research Council's (NRC) logic model. Ms. Linnenbrink discussed common scientific credibility metrics and stated that ORD was looking for feedback and ideas to inform the development and communicate the impact of their research.

She stated that the Agency had started collecting metrics for the BOSC and SAB reviews and feedback from EPA program offices and regions on strategic research plans through regularly scheduled meetings.

Ms. Linnenbrink said that EPA also collected the number of participants in their K–12 Science, Technology, Engineering, and Math programs. She provided an example fact sheet displaying the importance of tracking how the Agency's scientists train the next generation, as measured by service hours. Regarding outcomes and outputs, EPA was currently collecting metrics for ORD-hosted workshops and webinars (e.g., number of, type of participants, number of continuing education credits awarded, survey workshop participants to gauge satisfaction levels), number of product downloads, number of subscribers to various research topic newsletters and updates, program and regional offices' requests for research products/publications, and counts of website and blog views. The individual research programs track products and outputs delivered and report these data annually.

Ms. Linnenbrink provided an example of the Human Health Risk Assessment (HHRA) listserv subscribers, which displayed how subscribers had increased over time. EPA used Google

analytics in tracking web metrics and the number of data downloads, allowing EPA to follow website traction and demographics. She provided an example of a workshop survey and explained how the survey queried participant satisfaction about the data and solicited feedback for data improvement. She mentioned the lengthy and complex process for survey approval. Ms. Linnenbrink presented an example of metrics for webinars, specifically from the SSWR webinar series, which provided the number of participants and demographics in each state.

Regarding scientific credibility, the Agency succeeds at tracking peer-reviewed publications and presentations, media coverage resulting from EPA research issued press releases, and metrics from EPA research social media (e.g., number of followers and “likes”). However, Ms. Linnenbrink stated that EPA could improve at tracking discussion surrounding research topics.

Pertaining to media coverage, she explained that when the Agency issues a blog or news release, they have the ability to use keywords in the news release and access resulting media coverage. Ms. Linnenbrink stated that most of EPA’s media coverage is not general media coverage but media who cover science.

Ms. Linnenbrink discussed the metrics that might capture the use of research results in decisions and regulatory actions collected for use in decision and regulatory action impact. She provided some ideas for metrics to collect, including partner and stakeholder satisfaction with research tracked through surveys, focus groups, or both, a small number of anecdotal success stories showcasing how research and tools are used, tracking engagement of ORD, program offices and regions in PACTS, tracking program offices, regions, state agencies, and international governments citing or using Agency research in their decisions, and changes in partner interest, understanding, and use of research results or tools.

She provided several examples, including an example of the Agency’s current efforts to track groundwater technical support. She explained that the impetus was to track communities in which scientists were engaged and provide the collected information to those assessing the issue in the state. She also displayed an example from the Homeland Security Regional Research Partnerships which showcased the Homeland Security (HS) research products used across the country and a case study success story about Chemical Safety and Pesticide Programs using the CompTox data for endocrine disruption. She shared a Children’s Centers grant research success story, in which the research findings informed an FDA decision regarding a new limit for inorganic arsenic in infant rice cereal.

Ms. Linnenbrink stated that ORD would like feedback from the BOSC regarding the most important and meaningful metrics. She stated that the Agency was collecting a wide array of metrics and recognized a need for automation and prioritization of metrics. ORD would also like BOSC input on quantifiable and qualitative metrics of research usage for decision making and regulatory actions, noting a need for consistency across research programs.

Discussion of Program Evaluation and Metrics

Deborah Swackhamer, Chair

Dr. Cozzens complimented the metrics effort and the use of newer sources of information. She noted the importance of recognizing the use of the metrics once collected. Dr. Galloway asked if any other organizations outside of the BOSC have requested these metrics. Ms. Linnenbrink stated that both stakeholders and Congressional leaders have requested them. Dr. Kavlock added that the Office of Management and Budget (OMB) would also benefit.

Dr. Swackhamer mentioned the NRC report evaluated the logic model for program evaluation, which stated that outputs can be illustrated with metrics, but inputs need to be evaluated with measures, evaluated narratively, and should also be peer-reviewed. Dr. Cozzens expressed that research had different types of outcomes, but it did not necessarily translate to environmental impacts. Many indicators and huge processes could dramatically underestimate the metrics. It was standard practice to use success stories and examples of impact to capture the rare events with big payoffs to justify the allocation of resources. Dr. Olsiewski stated that publications and data were helpful for a funding agency to determine if there has been progress toward the desired endpoints, clarifying that success stories and impacts are long-term goals. When Dr. Somasundaran asked if patents were tracked to measure impact, Ms. Linnenbrink stated that ORD does not currently track patents.

Dr. Flint observed “qualitative metrics” might be an oxymoron and raised the importance of defining terms. She noted one size does not always fit all, and not all metrics, even within ORD, are likely to fit all programs, topics, and tasks. She suggested an ongoing dialogue between experts within each program.

Dr. Olsiewski discussed how to quantify the use of resources. Dr. Richardson added that frequency of downloads, for example, does not necessarily equate to effectiveness. He wondered if there is a way to capture data from users with questions about the tool. Ms. Linnenbrink stated that would require a survey and OMB approval.

Dr. Swackhamer discussed the balance of metrics weighted to the input side of the model, how they affected the input metric, and how they related to an output that could be acted upon. Dr. Olsiewski commented that certain metrics cannot be measured in certain timeframes. Dr. Rubin questioned whether the topic required more meaningful discussion in small groups.

Dr. Swackhamer asked the BOSC members for their opinions on how to move forward. Dr. Cozzens asked if the BOSC could measure the impacts of the Roadmaps’ areas across the NRPs. Dr. Swackhamer stated that the Roadmaps could be relatively consistent across the programs. Dr. Flint discussed the order of evaluation and the need to categorize into stages. She explained the charge questions were not always answerable without certain metrics. She asked what metrics could be developed to help address reports. Dr. Kavlock stated that in FY19, the BOSC would be asked to evaluate the StRAPs and mentioned that it would be beneficial to know the type of evidence needed to effectively evaluate the programs.

Dr. Chaudhry stated one way to measure success was to look toward the private sector for guidance and examine the market penetration of a product to determine the effectiveness of EPA research.

Dr. Richardson asked if the Agency could gather data and surveys from workshop participants and other groups. The committee discussed the use of surveys and ways to reduce the burdens on the program offices and state agencies.

Dr. Flint and Dr. Swackhamer discussed steps to make a visible difference in the community. Dr. Swackhamer stated she would draft a memorandum for the BOSC to suggest metrics and measures. Dr. Bahadori mentioned there was a disparity in the maturity of the different programs and said that CSS wanted metrics to move towards impactful research.

Dr. Rubin discussed the review of the CEH Annual Report and stated they found it difficult for the report to reflect the substantial work being performed. Dr. Flint declared it was an immense

undertaking and cautioned against gathering metrics just to gather metrics. Ms. Linnenbrink commented that ORD had recognized that the collection of some metrics might be unnecessary for some programs and others could be improved.

Dr. Swackhamer reviewed the BOSC's plan to move forward and suggested they form a four-member subcommittee to synthesize some suggested metrics for the larger committee. Ms. Smith agreed to also serve on the subcommittee with Dr. Cozzens, Dr. Corley, and Dr. Olsiewski.

Presentation on Social Science

Bryan Hubbell, ORD, and Robert Richardson and Courtney Flint

Dr. Hubbell stressed the importance of understanding that effective environmental regulations and policy must consider human behavior (e.g., context, interpretation, and perception) and decisions to protect human health and the environment should be based on the best available science, including both social and natural sciences. He observed ORD science has historically focused more on physical and natural sciences.

EPA has received advice concerning the incorporation of social science into research planning from several advisory bodies. Most notable is the advice from the National Academy of Sciences suggesting that environmental decision processes consider decisions made by individuals and communities.

Dr. Hubbell declared ORD has worked to increase its social science capacity by improving infrastructure, developing partnerships across EPA and other federal agencies, integrating social science principles into ORD's research, and identifying resource needs. He noted ORD developed a proposal to meet those challenges in the short-term (4 months), medium-term (8 months), and longer-term (12 months or more) timeframes.

ORD's infrastructure goal is to successfully incorporate social science expertise, models, and data as a regular part of research. In thinking about how social science perspectives could be incorporated, Dr. Hubbell clarified ORD wants to consider social science in an interdisciplinary manner. Actions from an infrastructure standpoint include drafting a social science vision statement for ORD, identifying key leaders in ORD and across the Agency who would be strong champions for ORD social science capacity, designating a senior social scientist in ORD to coordinate initiatives across ORD, with other parts of EPA, and with the larger social science community (e.g., the regions and academic institutions), strengthening the Agency's recently established Social Environmental Science Exchange (SESE) to enable facilitated dialogues, and expanding the ACE Social Science Toolbox.

Dr. Hubbell discussed that ORD's partnership goal is to gain a better understanding of how to incorporate social-environmental science into ORD research planning. This required engaging with internal and external partners to access available training and facilitation in the development of interdisciplinary research, working across EPA to share experiences as they develop their own framework for realizing the benefits of interdisciplinary social-environmental science, and identifying potential areas for research collaboration that could benefit from shared data, expertise, and resources. At the time of the meeting, social sciences were focused internal on EPA, but Dr. Hubbell stated he would like to see it expand to other federal agencies and academic institutions.

In terms of the integration of social science into ORD research, Dr. Hubbell explained the goal was to expand and strengthen ORD's consideration of social science methods and data in their research, as appropriate.

The first action involved the cross-training of scientists by holding workshops to provide insights into the value and practice of social science in research. Examples include the Wildfire Smoke and Health Risk Communication Workshop held in September 2016 as well as the Workshop on the Integration of Social Sciences in Environmental Health Research, where EPA intended to reach out to ORD managers and project leads to obtain a basic understanding of how social sciences are applicable to their research programs. Other actions for integration included evaluating opportunities where social science could enhance current projects and including social science experts in all stages of future strategic research planning. The social sciences extend well beyond communication and outreach to communities. Dr. Hubbell stressed the importance of addressing social sciences from the beginning of the planning process.

Dr. Hubbell stated that although the immediate resource need of designating a senior social scientist in ORD was fulfilled, longer-term resource needs would be identified through a series of next steps to implement recommendations. ORD needed to identify and fill gaps in expertise, identify full-time equivalent and budget resource needs to implement hiring, and then target post-doctoral hires to work in the key areas identified.

For the next year, Dr. Hubbell explained ORD hoped to give presentations for social scientist associations, begin using EPA's SESE's facilitated dialogue function to brainstorm proposed social science research activities, and draft an ORD social science vision statement and communications plan. In the fall of 2017, ORD expected to have targeted workshops on crosscutting social science issues and expand SESE to include federal interagency social science experts.

Dr. Hubbell acknowledged ORD would be completing pilot projects on facilitated dialogues. One of the outputs of the Social Science Workshop was a homework assignment for the NRPs to provide candidate ideas regarding research projects that would benefit from social science topics, and ORD would pilot the integration of social science through facilitated dialogues. To start the dialogue, ORD initiated the SESE in the late summer of 2016. The purpose of the SESE was to facilitate integration of social and environmental sciences to address important environmental challenges related to protecting human and environmental health. Invitations were sent to EPA social scientists and those who used social science research. ORD also collected survey data on potential usage of the SESE. Dr. Hubbell mentioned monthly meetings were focused on information sharing and presentations on current social science topics such as the use of social and behavioral insights in the design of outreach and education materials for Flint residents. He noted a meeting would be held the following week to discuss additional research topics on case studies related to water resources.

Dr. Hubbell demonstrated the breakdown of the SESE network. Sixty-one percent of those who signed up were both a producer and user of social science research, 38 percent were users of social science research, and only 1 percent were producers of social science research. Across the Agency, 45 percent were from ORD, and there were numerous economists from the Office of Policy. Dr. Hubbell stressed they are actively seeking additional participants.

The facilitated dialogue approach was based on the approach being developed by the U.S. Global Climate Change Research Program called the Resilience Dialogues. The approach uses an online

platform for facilitated online conversations (i.e., the MIT Community Innovators Lab platform). The idea involved a three-phase approach. Phase 1 involved social science experts helping ORD environmental researchers develop questions to understand the social and economic dimensions of a research topic. Dr. Hubbell noted the first phase was important because the broader community of physical and natural scientists are unsure what questions to ask. The first stage helps people formulate the questions. Phase 2 brought together ORD environmental researchers and social science experts to discuss social, demographic, and economic considerations and how they might influence the design of interdisciplinary research tasks. The last phase included social science experts identifying relevant disciplines, data, tools, resources, and strategies to address the research questions to begin developing a research plan. Dr. Hubbell clarified the process would be led by a volunteer facilitator from the SESE, and the deliverable would be a list of recommendations. ORD is brainstorming the ways to implement the process, how often to hold the meetings, and whether they should use webinars and other electronic forums. He noted ORD plans to address two projects immediately and an additional two projects later in 2017.

Following receipt of the candidate projects for deeper exploration of social science dimensions in the research, ORD selected four candidates for pilot dialogues. Their choices were based on the candidate's willingness to engage with the exchange, whether the questions were likely to be of interest to social scientists who might be asked to lend their input in problem formulation, if their questions were ones for which enhancing social science input would meaningfully impact the research, and if EPA had the capacity in the social sciences to address the questions being asked. Dr. Hubbell noted they were not currently able to reach outside of the Agency.

The first pilot chosen was from the HHRA program on cumulative exposures, social determinants, and health in Philadelphia. The project addressed how to integrate non-chemical stressors in cumulative risk assessment specifically by testing what social factors might modify associations between health effects and chemical and non-chemical stressors in a community near a refinery in South Philadelphia. The project also addressed how exposures to chemical and non-chemical stressors might disproportionately burden vulnerable populations. HHRA asked for help designing and implementing focus groups related to perceptions of surrounding environment and factors that influence neighborhood environments, addressing questions related to combining social and environmental data, designing and conducting focus groups around community environmental issues, and interpreting results from focus groups in a larger context.

The second pilot was ACE's project focused on collaboration and coordination of public health approaches and integrating environmental health and health care practice. The project was a major initiative ACE had moving to a public health context and focused on combining several different partners across federal, state, and local governments as well as non-governmental officials (NGOs) to establish collaborations related to air pollution and health (e.g., environmental public health messaging and integrating environmental health evidence into health care practice). ACE asked social sciences for assistance in identifying effective ways to motivate the healthcare system to add environmental information to patient care programs, identifying ways to increase environmental literacy especially for at-risk populations, understanding how inconsistent messaging can impact behavioral responses, and identifying effective ways of conveying complex environmental messages to improve health.

Dr. Hubbell discussed the third pilot—SSWR's project on nutrients thresholds and targeting, which highlighted indicators of biological response to nutrients that were socially meaningful and ways to combine social and economic factors with environmental effects information to

inform nutrient management. They hoped to complete this work by developing better indicators of biological responses to changing nutrient conditions, evaluating aquatic ecosystem response and recovery trajectories to changing nutrient loads, and developing and using tools, data, and scientific analyses to inform prioritization of watersheds for management of nutrients. SSWR asked social scientists for aid in evaluating which biological indicators have social meaning, the design of scenarios for nutrient management, the development of models with social and ecological feedbacks, translation of effects into ecosystem services, and communication of results to decision makers.

The final pilot was SHC's project on social determinants of health/interaction of social and environmental stressors. Their goal focused on well-being and health disparities, interactions of social and environmental stressors, and measurement of social stressors at appropriate scales. SHC asked for help in determining the most influential non-chemical stressors for health and well-being, identifying methods to measure social stress using citizen-science, and understanding the breadth and depth of the non-chemical stressors that impact people in their everyday lives. Dr. Hubbell stated all four projects would benefit from conversations with the social science community.

Dr. Richardson thanked Dr. Hubbell and Dr. Elizabeth Corona for their contributions. He noted that the social science engagement process began a year prior with monthly teleconferences with experts throughout the Agency, not just ORD. They also had weekly or biweekly teleconferences with Dr. Hubbell and Dr. Corona detailing the social science integration workshop.

Dr. Richardson explained they called the communication with ORD to plan for social science a "bootcamp," and Dr. Richardson and Dr. Flint worked together to plan and execute. The 2-day workshop's overview included "Making Sense of Social Science," and it involved two case studies: (1) social science and water systems and (2) social science and environmental contamination. He noted they had approximately 40 scientists and program office administrators in attendance and more than 100 Agency staff members participating via webinar. They were impressed by ORD's deep engagement in the workshop. The topic was new to many ORD staff, and they approached it with genuine interest and openness.

Dr. Richardson presented a diagram to set context for their vision. They wanted to use the workshop to make sense of social science and discuss with the group how social science could be integrated in the research process. They also had research examples displaying social science usage, case studies, and value.

Social science is the study of how society works, relationships among individuals and entities, determinants of human behavior, and drivers of human attitudes, beliefs, and decision making. Social science's mission is to understand human interaction and organization. Social science is not opinion polling, outreach, extension, or training. He noted their importance, but underscored that social science is based in true scientific inquiry.

One myth about social science is that it is not objective or hypothesis-driven. Some types of social science are not hypothesis-driven; Dr. Richardson explained the research question might be emergent and only require statistics. Another myth was that social science is anecdotal and findings from social science are reducible to biological or chemical processes. He noted that often social science is restricted in utility when considered too late in the research process.

In environmental social science, Dr. Richardson commented on the increasing complexity, emphasizing integration, interdisciplinary, and systems thinking, adaptive processes, non-linear relationships, and causal feedback loops. They chose to emphasize the inseparability of human and physical worlds. In environmental management, it is often people being managed as much or more than natural resources or environmental conditions.

Dr. Richardson displayed an image on social-ecological systems parameters with axes being an intervention of practice that are socially adoptable or not adoptable. It approaches a complex quadrant when there are socially unadoptable or undesirable interventions and a vulnerable or non-resilient system. The graph demonstrated where “wicked” problems called for an engaged and interdisciplinary sustainability science. On the x-axis, there was a value conflict. He also emphasized the importance of integration extending beyond the natural sciences and even beyond the social science fields that are now within the collaborative comfort zone of environmental scientists.

Dr. Flint displayed six principles to illustrate key concepts in environmental social science because social science is often broad. The first stated that society is vertically and horizontally organized. The second demonstrated that people make choices, and there are many factors that influence those choices. Attitudes do not always match behaviors, and one cannot just look at opinions and equate them to what people are willing to do. The fourth explained that context matters. What happens at a certain place or point in time might not be generalizable across conditions. The fifth stated that environmental quality is not distributed equitably. The final principle was that framing matters. How someone communicates about issues influences actions and perceptions.

Some things within society can be measured quantitatively. Key social science indicators involve well-being, values, agency, and inequality. Issues of power, culture, and injustice are not easily measured using quantitative indicators. Dr. Flint explained there were tools to help assess progress. Social science can be integrated in their missions by principles of the entity, beliefs, attitudes, intentions, skills, circumstances, and timing.

Dr. Flint explained their reasoning behind presenting case studies. In reality, case studies are usually done at a project level within certain tasks in the research program. They wanted to present examples about social science research that was integrated and that address complex interactions between the physical, natural, and human systems. She noted they completed the same for the social dimensions of environmental hazards and contaminated sites.

To conclude, Dr. Flint communicated that although social-ecological systems are complex and dynamic, social science unpacked social complexity and illuminated opportunities for intervention. People make context-dependent environmental choices, influenced by socioeconomic and cultural factors. Social science assesses factors influencing choices, and supports decision making with innovative tools and approaches. Environmental and health challenges are unevenly distributed across society, and one-size solutions rarely fit all situations. Dr. Flint noted social science investigates inequality, provides robust methods for valid evidence, facilitates fair and representative procedures, and supports context-sensitive policy and management options.

Dr. Richardson continued by stating the main takeaway he observed was that ORD is taking social science seriously, and it was impressive to engage with the managers of the workshop

because they were eager to learn. He noted it was also important to integrate with other partners and agencies that perform social science work.

Dr. Flint acknowledged there could be tendencies to find the one social science question everyone ponders. While many believe social science involves convincing the public to take action, ORD needs to turn to scientific inquiry. It is daunting, but it could move ORD away from normative approaches. Complexity is not always wicked; it is reality, and the world is complex. She urged ORD to continue integrating and thinking across disciplines. She and Dr. Richardson enjoyed the deep dive with ORD into social sciences over the past year, and it was an impressive effort.

Discussion of Social Science

Deborah Swackhamer, Chair

Dr. Swackhamer asked what the BOSC could do to facilitate these efforts. Dr. Hubbell explained they have had numerous conversations about social sciences and how to build the networks. ORD needs to make connections and leverage the on-going work inside and outside the Agency, so input from the BOSC in this area would be beneficial.

Dr. Richardson said another role the BOSC could play is integrate social science into additional projects to clarify its role. Several of the project leads want assistance disseminating information and communicating science, which is not scientific inquiry or the core of the social sciences. He noted the BOSC should continue to emphasize the scientific role of social science.

Dr. Hubbell suggested two needs: (1) to identify areas where an integrated approach makes sense, and if ORD plans to do that, they will need to reward staff for doing so, and (2) to build the infrastructure to integrate. ORD would benefit from the encouragement of permanent allocation of resources towards this effort.

Dr. Olsiewski asked if all four candidates were going to take place as pilot projects, and Dr. Hubbell replied ORD hopes to move forward with all four. They want to evaluate two in the near-term and proceed with the other two after the first two are completed. Dr. Hubbell explained that during the problem formulation workshop, social scientists within the Agency conducting observations of people participating in the structured breakout groups to identify how the dynamics of problem formulation work.

Dr. Cozzens noted that the National Science Foundation (NSF) had a commitment to what is called “wildly interdisciplinary projects.” She mentioned it might be worth discussing the experience with social science experts at NSF. Citing an example at her institution, Georgia Tech, she noted the obstacle to integration was training differences (e.g., engineers and computer scientists). She noted that ORD is overcoming this obstacle through these efforts. She mentioned one of her colleagues, Dr. Nancy Nersessian, would be helpful and interested in the effort.

Dr. Flint explained when it came to the BOSC, if it is ORD’s aim for social science to become part of the review process, all subcommittees would need the underlying expertise. She stressed the need for experts with interdisciplinary experience. Close-minded social scientists might not be helpful on the BOSC, but Dr. Flint emphasized those who have performed integrative interdisciplinary work would be beneficial. Ms. Smith noted Dr. Hubbell came to the ACE subcommittee meeting, and the focus was on the integration of social science into the ACE program. She thought other subcommittees might benefit from a similar engagement. Dr. Swackhamer clarified social science would eventually be included in all subcommittee reviews.

Dr. Rubin said during their first BOSC subcommittee meeting in 2015, they looked at health, not just in terms of toxics in the environment causing problems, but the individual in the community in an ecological framework. He was impressed with the transformation from linear cause-and-effect to an ecological framework of well-being. Dr. Hubbell explained the importance of supplementing the BOSC with social science experts. Dr. Swackhamer noted the importance of involving social science in the problem formulation stage and beyond.

Thursday, January 12, 2017

Safe and Sustainable Water Resources Subcommittee Draft Report

Joseph Rodricks, Chair; Shahid Chaudhry, Vice Chair

Dr. Chaudhry covered the research topics of the SSWR StRAP for 2016–2019. He stated that the focus of the 2016 review was on Research Topic 4: Water Systems. Within the topic of water systems, there were four broader research objectives: (1) to support the delivery of safe drinking water by existing water systems, (2) to identify and assess health risks of current and emerging contaminants, (3) to identify near and longer term challenges to maintain safe drinking water and sustaining water resources, and (4) to develop and help implement new technologies to meet the near- and longer-term challenges.

To achieve those objectives, there were three water system projects: (1) current systems and regulatory support, (2) next steps: technology advances, and (3) transformative approaches and technologies for water systems. The purpose of the three integrated research projects was to: (1) define optimal resource recovery-based systems, (2) develop advance monitoring and analytical tools, (3) improve technologies for collection, treatment, and distribution of drinking, resource, and reclaimed water, (4) recovery of resources, and (5) advance technologies for identifying and assessing health risks.

Dr. Chaudhry restated the subcommittee’s charge questions (see Appendix C for the full list). He explained that the subcommittee reviewed the three water systems projects during their subcommittee meeting on August 24 and 25, 2016, in Cincinnati, Ohio. They determined overall the water systems program was well designed and executed, and the program was on track to fulfill its challenging objectives. He underscored that the Draft Report contained additional commentary on the projects and included some of the recommendations for ORD and SSWR’s consideration. He highlighted some of the current research for tasks 1A–1D.

Dr. Chaudhry reported the recommendations for Project 1. Overall, the subcommittee agreed it was well designed, but there was greater emphasis needed on all exposure pathways for lead (rather than water only), shorter-chain perfluorooctanesulfonic acid (PFAS), ultraviolet (UV)-disinfection by-products health risks, health risk assessments of short-term applications of reclaimed water, and water quality changes in the distribution systems. The subcommittee recommended there was not a need to focus separately on whether reclaimed water enters the potable water supply directly or indirectly. The resources for design of “premise plumbing” and for antibiotic resistance in resource waters should be re-allocated to higher priority tasks.

He discussed highlights of current research in Project 2. Dr. Chaudhry explained that the subcommittee suggested a strong water research program might be made more effective by increased efforts to work more closely with other federal agencies already involved in similar research activities. Recommendation 2 stated SSWR needs greater clarity on how the research

timelines relate to short- and long-term needs. Lastly, they suggested ORD work on long-term needs to address salinization, nitrate, and emerging chemical contaminants.

The subcommittee made recommendations for Project 3, including the application of new tools for pathogen identification and quantification to resource water to improve decisions on potable water reuse. The subcommittee explained that although the use of bioassays and sensors for rapid screening of chemical mixture toxicity was important, field deployable technologies were not always needed. Instead, off-line systems should be considered. Lastly, the subcommittee recommended greater clarity regarding the incorporation of ecological impacts into the research framework.

Dr. Chaudhry stated that the SSWR subcommittee met in conjunction with EPA's 13th annual drinking water workshop, and members had the opportunity to attend presentations and review posters. He highlighted a presentation by Dr. Chad Seidel, University of Colorado, who directed the Design of Risk-reducing, Innovative-implementable Small-system Knowledge (DeRISK) Center, which was one of two National Centers funded by SSWR through STAR Grants. During the workshop, Dr. Seidel demonstrated how research efforts directed at health risk reduction could be planned and evaluated under a decision framework nearly identical to what the NRC proposed in its *Science and Decisions* report.

Dr. Richardson and Dr. Swackhamer requested clarification on expanding the purview to lead. Dr. Swackhamer did not understand the difference between the work currently being done versus the work being recommended. Dr. Chaudhry answered he would need to clarify these details with the other subcommittee members. Dr. Geller agreed that SSWR and SHC could have a close interaction on the lead and copper rule and moving forward with Stochastic Human Exposure and Dose Simulation (SHEDS) and Integrated Exposure Biokinetic (IEUBK) modeling. Dr. Swackhamer suggested clarifying the language because it sounded like a regulatory effort. Dr. Kavlock stated that part of the issue was trying to develop a national standard for a local problem.

Safe and Sustainable Water Resources Program Comments

Suzanne van Drunick, SSWR NPD

Dr. van Drunick thanked the SSWR subcommittee for attending the August meeting and stated that the recommendations were beneficial for research planning and implementation. The SSWR research program agreed with all recommendations but solicited clarification on a few specific details. She also thanked Mr. Joe Williams, Dr. Chris Impellitteri, and the ORD researchers for their efforts.

Dr. van Drunick discussed Project 1 and highlighted two recommendations. The first recommendation stated that research on potable water reuse need not focus on whether reclaimed water enters the potable water supply directly or indirectly. She clarified the terminology was still evolving and was globally inconsistent. She agreed that human health should focus on the technical aspects versus directness or indirectness, and the classification was not necessarily productive. The subcommittee's thinking aligned with the NRC on direct versus indirect potable reuse, but there seemed to be a division on approaches.

The second aspect needing clarification was the recommendation for Project 1 that suggested SSWR pay greater attention to shorter-chain PFAS. SSWR agreed. Dr. van Drunick explained that SSWR participates in two cross-Agency workgroups on analytical development and toxicity

(e.g., CompTox). She mentioned they were researching analytical method development which would target Unregulated Contaminant Monitoring Rule (UCMR)-listed analytes in addition to 18 additional analytes that included shorter-chained PFAS. SSWR prioritized new and existing PFAS for high-throughput and computational toxicological assessments, and shorter chained PFAS would be included in the process.

She discussed the recommendations for Project 2, which related to clarity on timelines and how they related to short- and long-term research needs. Dr. van Drunick agreed that SSWR could have provided more information to the subcommittee to help address Charge Question 2. Dr. van Drunick commented that, within the water systems portfolio, SSWR could have provided more details related to the timelines for completion and provided examples. The RARE projects operated in a 1- to 2-year timeframe, while the PIP program was funded in 2-year phases; if successful, they could move to full-scale evaluation. She clarified that SSWR would articulate that more clearly in the future.

Dr. van Drunick reviewed the recommendation for longer-term needs to address salinization, nitrate, and emerging chemical contaminants. She explained that SSWR had not invested many resources in salinization, as there are many other companies already performing work in that area. She stated that SSWR would indeed include the recommendation in their next planning cycle and coordinate with other NGOs and federal agencies to make sure the Agency is making the greatest contribution. Current SSWR research includes innovative small systems technologies for biological treatment of nitrate in groundwater and new UV technologies (e.g., light emitting diode-UV) for water disinfection and evaluations of alternative disinfectants, such as ferrate and peracetic acid.

Dr. van Drunick discussed two recommendations for Project 3. The first stated that new tools for pathogen identification and quantification should be applied to raw sewage to improve decisions on potable water reuse and greater clarity regarding the incorporation of ecological impacts into the research framework. SSWR agreed with the subcommittee's recommendation, assuming that adequate resources exist for pathogen characterization for developing log-reduction values (LRVs) for potable reuse. SSWR would also need to closely collaborate with the Office of Water (OW) to ensure that any LRVs developed for potable reuse were part of any potential guidance issued by OW. In addition to further characterization of raw sewage, SSWR anticipated that LRVs would need to be developed for potable reuse of greywater.

She stated two meetings are scheduled for 2017 with the BOSC. A joint meeting would consider nutrients and harmful algal blooms as well as green infrastructure. The second meeting will review watershed sustainability and will address the recommendation on ecological impacts.

Discussion of Safe and Sustainable Water Resources Subcommittee Draft Report

Deborah Swackhamer, Chair

Dr. Swackhamer requested clarification on the comment to defund or limit resources for the research related to disinfectants and microbial resistance. Dr. van Drunick was also curious to hear the reasoning, although she pointed out that SSWR asked the subcommittee to consider areas in which SSWR could reduce their efforts.

Dr. Swackhamer also inquired about the recommendation regarding PFAS acceleration. Dr. Chaudhry stated the subcommittee made the recommendation based on the information provided; however, he realizes it could simply be an issue of obtaining additional information.

He stated the subcommittee would be happy to discuss a modification to the recommendations after reviewing additional background information.

Dr. Impellitteri stated that the two workgroups that Dr. van Drunick mentioned were formed approximately 2 weeks after the BOSC meeting, so they were relatively new. He noted the main focus had been on PFAS in existing sites and there was increased collaboration with the National Institute of Standards and Technology (NIST) and the Department of Defense (DoD), in particular, on understanding which PFAS exist in these sites and what the drinking water threats are.

Dr. Kavlock asked for clarification on “premise plumbing,” as it was another area of disinvestment. Dr. van Drunick agreed, and she thought the subcommittee was suggesting that SSWR not weigh in on the design of the infrastructure but rather continue the work on the impact.

Dr. Impellitteri added that SSWR realizes it does not have the necessary in-house resources to complete this work, which is why the subject needed attention. U.S. Representative Matthew Cartwright increased funding to NIST and introduced a bill to modernize the nations plumbing standards and they hoped to collaborate on the issue of water quality rather than the design.

Dr. Somasundaran commented about short-chain and long-chain alcohol PFAS, stating that long-chain PFAS are more surface-active and can penetrate membranes, whereas short-chain PFAS are relatively benign. He suggested the important relationship between iron in the system and release of lead and arsenic. Dr. Chaudhry said he would be happy to consult with Dr. Somasundaran and capitalize on his expertise on PFAS.

Dr. Kavlock stated the perfluoronates are a different type of chemical. The Agency is moving away from long chains, as there is little exposure and health information for the short chains. Dr. Somasundaran agreed, but he reiterated his concern was that the more toxic longer chains might be deemphasized if the shorter chains were emphasized. Dr. Impellitteri stated that would not happen as SSWR investigates substances with chains between 2 to 16 carbons.

Dr. Richardson reminded the EC about phrasing and targeting specific, actionable recommendations.

Dr. Swackhamer asked for clarification on the discussion of Task 1C on page 12. She did not understand the content of the three paragraphs. The recommendation to “consider further investigation of IG methods, cultural techniques...” and the “BOSC believes the development and validation,” seemed to contradict “erroneous decision making.” Dr. Chaudhry agreed to clarify.

Dr. Cozzens reiterated that SSWR provided minimal information to inform disinvestment or defunding recommendations. She also stated that the EC should also consider stakeholder involvement to understand the broader impact of defunding certain activities. Dr. Swackhamer clarified that the BOSC discussed comprehensive planning for crosscutting programs, but their review of certain research programs focused on the evaluation of a specific piece, rather than the entire program. Agreeing that a piecemeal review can create issues, she acknowledged that further information would be critical and urged the EC members to consider what additional data or metrics would be useful.

Dr. Rubin stated that different areas of the country have different issues, and the needs are regional. He stated, for example, that certain farming areas use more antibiotics than pesticides and nutrients, while the opposite is true in other areas. Dr. Flint suggested that SSWR think about the “right science at the right time and in the right context” and suggested adding a comment in the report to capture the importance of context-dependent solutions. Dr. Olsiewski agreed and noted the direct interaction and communication between the regions and their partners in the Homeland Security research program. She surmised the other programs operate similarly. Mr. Williams replied that the purpose of the small systems workshop was to obtain a national perspective on the drinking water system, and SSWR has national science liaisons who are actively engaged in addressing regional needs.

Dr. Swackhamer asked for clarification on the comment regarding working with the non-profit organization National Water Research Institute (NWRI) to develop independent guidance. She noted its specificity and asked why the subcommittee, not OW, had made the recommendation. Dr. Impellitteri stated the focused recommendation was, in fact, from OW, but acknowledged OW is reluctant to endorse any viewpoint that could be biased. Dr. Swackhamer requested further clarification on this topic, particularly because SSWR does not write regulations. Dr. Impellitteri mentioned that SSWR had researchers involved in the blue ribbon panel in California working on decentralized non-potable water reuse guidelines and NWRI was part of that panel. Dr. Swackhamer explained she understood the issue, but still did not understand the reason. Dr. Chaudhry stated he will look further into this issue and clarify the details in the revised report.

Next, Dr. Swackhamer pointed to the recommendation to avoid the possibility of overlapping resources and efforts. She stated that SSWR is working hard to collaborate and the BOSC does want to recommend something that would create an issue of diminishing returns.

Dr. Rubin asked about community engagement to determine research priorities. Dr. van Drunick discussed SSWR’s ability to reach a broad audience by conducting webinars and communicating with the states to address their needs. Mr. Williams noted that Ms. Linnenbrink showed metrics from this webinar during her presentation. Dr. Rubin thanked Dr. van Drunick for their engagement with the community. Dr. van Drunick offered to provide the subcommittee with additional information on the program’s collaborations with NIST, USGS, DOD, and other federal partners.

Dr. Swackhamer summarized the edits to the draft SSWR report:

- Recommendations that are not actionable be moved into the text (i.e., Recommendation 9).
- Recommendations should include clarified phrasing and their justifications should be included and/or expanded (i.e., PFAS, microbial resistance, water design/premise plumbing).
- The report should be organized by charge question.

Sustainable and Healthy Communities Subcommittee Draft Report

Robert Richardson, Chair; Courtney Flint, Vice Chair

Dr. Flint began by thanking the subcommittee members for their efforts. She noted their discussion and report was focused around SHC’s Topic 3: Sustainable Approaches for Contaminated Sites and Materials Management. The focus resulted from their previous meeting, when the subcommittee considered the details of the relationships between ORD, the regions,

and the program partners to evaluate the research. She stated that SHC was responsive to their request, and the meeting took place November 2–4, 2016, in Cincinnati, Ohio. SHC provided the subcommittee with materials, presentations of research, and lab tours.

Dr. Flint stated Topic 3 included three projects: Project 3.61 – Contaminated Sites, Project 3.62 – Environmental Releases of Oils and Fuels, and Project 3.63 – Sustainable Materials Management (SMM). The materials presented were divided between the three areas that structured the subcommittee’s review. Dr. Flint reviewed the charge questions (see Appendix C for the full list).

The subcommittee was impressed by the scope and quality of research within SHC’s Topic 3. Dr. Flint underscored the program’s challenge of balancing basic and applied science and pointed out that while the subcommittee was charged with considering research applications, much of presented material emphasized basic science research. Further, she stated that although the subcommittee made comments and recommendations related to community sustainability, they did not have a clear understanding of the research mandate. Dr. Flint stated that the subcommittee responded to the charge questions based on their expertise and the provided information. She recognized, however, that the subcommittee did not want to make recommendations that burden the scientists and encouraged the program leads to clarify any misunderstandings.

Related to Charge Question 1, the subcommittee felt the projects met Agency needs well, particularly in the area of technical support. State needs were addressed as well, particularly because SHC recognized the heterogeneity across states. Local community needs were met as well, but did not appear to be a main focus. In general, the subcommittee thought the PACTs would be helpful in assessing needs. The subcommittee recommended gathering stakeholder input annually via a systematic needs assessment and following the principles of community engagement to build relationships and enhance communication, which will enable SHC to match priorities with needs.

Dr. Flint explained the subcommittee organized their response by project. Regarding contaminated sites, they felt SHC met Agency and state needs, while the degree to which community needs were met varied. The first recommendation informed technical support provision (Task 1) with tools for evaluating spatiotemporal impacts of contaminated sites on the environment (Task 5). Secondly, the subcommittee recommended to use Areas of Concern (AOCs) as a model for engaging stakeholders on priorities. The third recommendation suggested SHC provide opportunities for interaction among stakeholders. Finally, the last recommendation related to contaminated sites was to have inter-agency collaboration to leverage research on site revitalization. Dr. Flint mentioned this is a local community-related issue.

Regarding the oils and fuels releases project, the subcommittee saw ample evidence of technical support, especially in the states. Their recommendations began with obtaining responder feedback on research utility and oil/dispersant behavior. Secondly, the subcommittee recommended directly incorporating community needs in the validation of basic research. The final recommendation related to oil and fuels suggested SHC work with states to improve data quality on water supplies with regard to leaking underground storage tank (LUST) sites.

For the sustainable materials management project, the first recommendation was to formalize communication between EPA’s Office of Land and Emergency Management (OLEM) and SHC. The subcommittee’s second recommendation involved increasing fellowships and scholarly

opportunities for SHC researchers. The last recommendation was to survey the landscape of other SMM practitioners and potential partners.

Dr. Flint explained the Charge Question 2 dealt with addressing future problems, long-term community sustainability, and EJ within the three project areas. To preface, she acknowledged that the subcommittee recognized decreased funding levels and staffing constrain the program's capacity to address future problems. Given these limitations, the subcommittee's first recommendation was to incorporate community engagement and social science expertise. The second recommendation suggested SHC rebalance the mix of expertise to include more social sciences. The subcommittee's third recommendation was to develop a plan to incorporate citizen-science in EJ research. The subcommittee's last recommendation was to develop predictive modeling tools in regards to alternative futures and trends.

Dr. Flint then reviewed the recommendations for the oils and fuels releases project. The first was to expand research capacity to anticipate oil and fuel type changes and new geographies associated with fuel extraction and transportation networks. Recommendation 2 suggested SHC consider changing water demand and land use affecting underground storage tanks (USTs). The third recommendation was to maintain resources and staffing to sustain and expand program expertise and capabilities. Recommendation 4 advised prioritizing procurement of reference oils and fuels for testing. The fifth recommendation referred to characterizing National Contingency Plan List products and sharing those with first responders. Recommendation 6 proposed exploring the effect of decarbonization of fuels on releases and LUSTs. The last recommendation for this project suggested integrating social scientists with spatial modeling expertise to identify disproportionately burdened communities and changes in oil and fuel releases.

Related to the sustainable materials management project, the first recommendation suggested increasing the frequency and quality of efforts to reflect the state of SHC knowledge (e.g., publishing reviews and peer-reviewed publications, increasing outreach, attending conferences, tracking policies). The subcommittee's second recommendation was to leverage OLEM's partners and gather input on future challenges. Third, the subcommittee recommended SHC use PACTs to identify long-term SMM trends and the related short-term research needs. Finally, Dr. Flint stated the last recommendation advised SHC to continue investing in resources such as the Materials Management Wizard (Mwiz) to communicate SHC work.

Charge Question 3 asked the subcommittee to contextualize contaminated site management within a broader community context, focused on improving community well-being. Regarding general observations and recommendations, Dr. Flint noted that historically the Agency has worked through the regions to ensure program effectiveness. The SHC subcommittee recognized the need to balance creating new direct community relationships with the potential to interfere with existing ones. The subcommittee did not feel they had the data and metrics to assess the charge question as it related to community sustainability outcomes. The recommendations related to Charge Question 3 urged SHC to continue encouraging research beyond immediate partner needs, consider the Agency's mission when evaluating potential investments, document formal assessments of partner needs for clear decision making, document formal and informal engagement processes to solicit needs to draw clear lines between problem formulation and project development, and evaluate program contributions related to outputs, outcomes, and community sustainability.

Dr. Richardson explained the subcommittee found it difficult to link SHC bench science and long-term sustainability, but acknowledged OLEM is in the middle of the continuum.

Dr. Aneja asked what was meant by the word “sustainability” in Charge Question 3. Dr. Flint replied that as they have defined it, sustainability is defined in the broadest sense and involves health and well-being, economic prosperity, environmental justice, social equity, and ecosystem services. She stated she will clarify the definition in the report, but noted SHC did not present the subcommittee with the data and metrics necessary to judge if the science contributed to increasing community sustainability.

Sustainable and Health Communities Program Comments

Andrew Geller, SHC Acting NPD

Dr. Geller began by stating that at their November 2016 meeting, SHC treated the SHC subcommittee to a deep dive into the world of environmental engineering to remediate contaminated sites; address the issues around the environmental releases of oils and fuels; sustainable materials management; and how to link to community sustainability with environmental justice. He noted that SHC not only asked the subcommittee to review the quality of the program’s scientific research, they also inquired about the impacts of this science, particularly as it relates to community sustainability. SHC designed the meeting to include major involvement from the program and regional office partners so the subcommittee could gain a better understanding of the nature of their interactions and evaluate the alignment of their research with the Agency’s mission in those areas, both near and long term.

Dr. Geller briefly reviewed the subcommittee’s comments and recommendations. He stated that SHC plans to enhance scholarly opportunities going forward. SHC scientists attend professional meetings, but Dr. Geller discussed organizing a semi-annual presentation of ORD research linking Superfund and brownfields research. To demonstrate a communicating impact, ORD has worked to break down “stovepipes” between scientific topics, with crosscutting roadmaps and other related efforts. Dr. Geller noted that the PACTs will aid in communicating ORD’s research successes across the Agency.

Dr. Geller stated SHC will require broad expertise to devise metrics of communication effectiveness, to link environmental engineering with individual and community values, and to understand, capture, and communicate the factors necessary for remediation efforts to successfully result in community revitalization. Finally, he noted SHC has endeavored to increase community input on program planning. He highlighted SHC’s growing investment in Eco-Districts and other collaborative agreements and partnerships within the Agency. He emphasized the need to increase these efforts in contaminated communities.

Discussion of Sustainable and Healthy Communities Subcommittee Draft Report

Deborah Swackhamer, Chair

Dr. Swackhamer asked Dr. Geller if any of the subcommittee recommendations are addressed by SHC’s other three research topics that were not part of this review. Dr. Geller responded that he was not concerned if they were. He added that although many of the recommendations would be appropriate for other parts of the program in terms of direct community input and planning, they were strong and appropriate recommendations.

Dr. Swackhamer commented that several recommendations encourage SHC to “incorporate social science” using specific details. She asked whether SHC has this expertise in house. Dr.

Geller responded that SHC has a few staff members with social science expertise, but the program would require a larger staff or a different way of thinking to complete the work. He referenced, for example, the use of post-doctoral researchers in their Duluth laboratory. Dr. Slimak responded that SHC is working hard to bring in social science expertise and has done so in unexpected ways. He explained that SHC new hires tend to have both a natural sciences background and exposure to the social sciences, as opposed to a social science training in the strict sense. He explained that the program will continue to emphasize this perspective in new hires in addition to hiring true social science researchers. Dr. Flint commented that SHC should clarify those details related to the inclusion of social science expertise when editing their report. She reiterated the subcommittee's recommendation to involve social science expertise was related to the Project 3 efforts and SHC should use their discretion in determining the best way to do so. Dr. Richardson agreed that recommending the involvement of social science expertise may be more feasible than involving more social scientists.

Dr. Kavlock commented that the subcommittee made several great recommendations, but he noted that some have resource implications, particularly those related to increasing community engagement. He added that it would be helpful if the subcommittee would identify the most important recommendations. Dr. Flint responded by explaining that the subcommittee can assist SHC in the development of effective approaches, but underscored that community engagement is critical to achieving the program's mission. Dr. Kavlock noted that this type of recommendation is "eternal" and the Office of the Inspector General (OIG) will expect the Agency to have a plan to address the recommendations. Dr. Flint acknowledged that on-going recommendations and those with resource constraints could be moved to the document's main text.

Dr. Slimak commented that OIG will ask what the community engagement entails. Community organizations (e.g., the Association of State and Territorial Health Officials) can help SHC at the community scale. He explained that there is also some basic science that SHC can apply to communities. He noted, for example, categorizing by community "types," though he acknowledged a lack of progress in this area. Dr. Flint suggested that the communities themselves should help identify priorities, and added that tool development will be a resource-efficient approach to achieve that goal.

Dr. Swackhamer asked about Project 3.61, Recommendation 1.2.1.R3 on page 9. She explained that the report states "provide support for community stakeholders to interact regarding common concerns and communicating these concerns, e.g., EPA Region 1 is providing support for the urban sustainability director's network." She requested clarification on ways to bring people together as opposed to simple financial support, adding that OIG will assume "support" implies financial support. She explained that it underscored Dr. Slimak's point that the recommendation was aspirational. Dr. Swackhamer asserted that aspirational recommendations should be moved to the main text. She added that the preceding recommendation (Project 3.61 Recommendation 1.2.1.R2 "Use the AOCs as a model for engaging community stakeholders in determining the priorities and best approaches for remediation and cleanup") was a great model. However, those 42 AOCs were determined previously, and there is a remediation program. Dr. Flint responded that the subcommittee was referring to what happens to those AOCs in the model; the current Remediation to Restoration to Revitalization Approach (R2R2R) happening in the AOCs are the model that can be used as the model for contaminated sites. She added the subcommittee would clarify this in their Draft Report.

Dr. Aneja asked if “ecosystem services” implied that air was not a component in this analysis. Dr. Richardson replied that the diagram Dr. Aneja referenced was developed in response to a previous charge question about OSWER (now OLEM), and explained that air quality was outside the scope of the original charge question.

Related to Dr. Hubbell’s point regarding the social scientist exchange, Ms. Smith commented that SHC could refer to the social science exchange as a way of responding to the recommendations to incorporate social science expertise.

Dr. Geller explained that the researchers are doing great work in the area of remediation and suggested more collaboration between the program and regional partners. Dr. Slimak agreed the recommendations in the Draft Report would not pose a burden to the scientists working in this topic area. Dr. Geller commented that the implementation time scale will be challenging, as the program will have to build new teams and expertise.

Dr. Swackhamer asked about Project 3.61, Recommendation 1.2.1.R.4, on page 9. She noted that this again suggested “increasing collaboration.” She asked if there is evidence that SHC was not collaborating enough, noting she believed they were. Dr. Cozzens urged the subcommittee to address the asymmetry in their use of supporting evidence. Dr. Swackhamer proposed adding specific collaboration opportunities. Dr. Flint commented that the last part of the recommendation suggests to “consider proactive collaborations and joint-agency initiatives such as the EPA-Housing and Urban Development-Department of Transportation sustainable communities program in order to advance the aims of site revitalization and urban regeneration.” She clarified that the reality is not that there is no collaboration taking place, but the existing collaboration might not address revitalization. Dr. Richardson added that they can reverse the recommendation and clarify. Dr. Swackhamer noted it could be included in the text or as a recommendation.

Dr. Rubin asked how SHC would engage the community. He explained that the model does not just address a toxic substance causing an adverse health effect, but is also looking at health and well-being in a community. He questioned how to convince the communities to reengage, and explained this was a revitalization issue. The scientists can remediate, but the social scientists engage the community sociologically and socioeconomically to participate actively in the process. Dr. Rubin suggested editing the recommendation to use the phrase “explore ways to engage” or “develop strategies to engage” versus simply “engage.”

Dr. Swackhamer drew attention to the text related to Project 3.62, Recommendation 1.2.2.R3, page 11 – “Work with states to improve data quality on proximate water supplies to investigate interactions with backlog LUST sites.” She inquired if that was EPA’s role and questioned how the Agency would interact with the states during that process. Dr. Geller responded that this would be OW’s responsibility, though SHC and regional staff have also been involved. Dr. Flint commented that when looking at the research, the subcommittee identified a need to clarify the proximity of USTs to wells. The point was to improve the data. Dr. Swackhamer suggested the statement be moved to the main text. Dr. Olsiewski commented that data quality is important, but the recommendation was too prescriptive. She suggested identifying strategies and partnerships that would result in good data or following Dr. Swackhamer’s suggestion to stress the issue in the text as opposed to a recommendation. Dr. Kavlock commented that it would be a two-way discussion with the states, and that the states will have to create that data. Dr. Flint suggested rewording the recommendation as “facilitate the exchange that could lead to improved

data quality” to make it actionable. Dr. Slimak suggested wording it as “in order to answer the question of UST and the risks involved, better information on where these groundwater sources are would be beneficial.”

Dr. Swackhamer commented on General Recommendation 2.1 on page 13 of the Draft Report – “Increase opportunities for graduate students and post-doctoral fellows to work at EPA in short-term assignments (2 to 12 months) 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.” She noted that hiring constraints are determined at the Agency level not by the research programs. She suggested moving this suggestion to the main text, as it is not actionable.

Dr. Swackhamer commented on the statement to “collect data on how communities interact,” which is related to metrics. She asked the subcommittees to mine their suggestions related to metrics, so the EC could send a list of metrics to ORD that will be helpful during the next BOSC review.

Dr. Swackhamer commended the organization of the SHC Draft Report, especially page 6 which explained the organization of the document and provided a guide for how to read the document. She added that this is something all subcommittees should consider in their revisions.

Dr. Kavlock commented on Project 3.61, Recommendation 2.2.1.R.3 on page 15, where the word research “roadmap” is used. He suggested avoiding the word “roadmap,” and suggested using the word “framework” instead.

Dr. Aneja asked for clarity on Charge Question 2 “planned research anticipated in the future problem.” He asked what was considered in terms of future problems. Dr. Geller responded that the land program was focused on developing a permeable reactive barrier, dealing with pressing and immediate problems. He added that the question asked whether SHC was using its scientific knowledge to address the next generation of issues and moving from a waste-based, linear economy to a resource-based, circular economy.

Related to the oil and fuel releases project, Dr. Flint commented that the Draft Report discussed anticipating oil and fuel type changes. She said that they did not want to list the future issues, but the text was meant to capture that idea. She added that there are changes in the types of fuels used, how they are produced, their chemical composition, and other aspects.

Chemical Safety for Sustainability Subcommittee Draft Report

Ponisseril Somasundaran, Chair; Gina Solomon, Vice Chair

Dr. Somasundaran began the presentation by introducing the CSS subcommittee members. He provided background on the subcommittee’s process and reviewed the charge questions (see Appendix C for the full list). He also gave an overview of the four CSS research areas.

Dr. Somasundaran began by reviewing the four recommendations related to the chemical evaluation topic. Recommendation 1.1 suggested articulating a unifying strategy for how transcriptomics data are being used in CSS to inform new assay development using the adverse outcome pathway (AOP) framework. Recommendation 1.2 was to develop a balanced strategy to retire existing assays that might not add sufficient value to the program while bringing on board new assays that add important biological content to the hazard identification mission.

Recommendation 1.3 suggested evaluate whether assays of single chemicals over- or under-

predict the effects of combined exposures to mixtures. Recommendation 1.4 stated the need to build links with ongoing NIH-funded cohort studies to use biomonitoring information from those studies and provide toxicity pathway information to enhance those studies.

Dr. Somasundaran reviewed the recommendations targeted at the complex systems science topic. Recommendation 2.1 suggested focusing resources on specific deliverables that move the AOP framework forward substantially in areas that exemplify the integration of complex systems science into hazard identification. The recommendation further suggested creating a pipeline of scientifically sound and accepted AOPs awaiting OECD endorsement. Recommendation 2.2 suggested the need to continue to advance the science in virtual tissue modeling, including the STAR program, and look for points of entry to application while extending the approach to other organs as resources allow. Recommendation 2.3 was to extend complex systems approaches into model organisms and intact systems to bridge the outstanding work done in vitro into read across species applications commensurate with AOP areas of focus for both ecological and human hazard identification. Recommendation 2.4 suggested the need to continue focusing on engagement and tackle “low hanging fruit” wherever possible to illustrate the power of applying systems science to risk assessment.

Dr. Somasundaran presented five recommendations targeted at the lifecycle analytics project topic. First, Recommendation 3.1 was that periodic updates of databases and checking against real-world exposure measurements are essential for keeping this work relevant and useful for risk-based decision making. Recommendation 3.2 stated that efforts should continue to integrate the hazard and exposure focused platforms describing chemical and materials behavior across the life cycle. Recommendation 3.3 was that future efforts should focus on end-of-life aspects of chemical use. Recommendation 3.4 stated that efforts linking databases and modeling of human behavior are making critical contributions to describe exposure in relation to consumer products and merit continued emphasis. Recommendation 3.5 suggested that the development of a data platform for emerging nanomaterials should be coordinated with a view to compatibility and functionality of other databases such as EPA’s CompTox databases.

Next, Dr. Somasundaran reviewed the four recommendations related to the solutions-based translation and knowledge delivery topic. Recommendation 4.1 called upon the development of an interactive tool or a graphic would help understand the relationships of the sources of data as it described that the work is detailed but the users could get lost on the way and not recognize how they all relate. Recommendation 4.2 suggested the need to develop a strategic plan for how to balance available resources for collaboration and training on CSS products in the near and long term with partners and external stakeholders, focusing on direct interactions as to how the tools can help partners meet their mission to protect the environment and public health. Recommendation 4.3 was to generate protocols for assessing the impacts of CSS research on partners and external stakeholders including researchers and the public. This should include development of metrics that document success for each of the research project. Dr. Somasundaran presented the last recommendation, which was to craft focused STAR RFAs that address a project area needs that build collaborations between CSS and external researchers, including investigators that do not normally work on environmental issues.

Ms. Smith asked whether the subcommittee applied both charge questions to each of the four research topic areas. Dr. Somasundaran responded that the subcommittee did apply each charge question to each of the four research topic areas. Ms. Smith followed by asking if the recommendations signify a gap in the CSS program or if it just signifies that integration could be

enriched. Dr. Somasundaran responded that there are always overlaps between recommendations and gaps, and explained that he tried to identify gaps relating to the specific recommendations in red in his presentation slides.

Dr. Rubin asked a question relating to Recommendation 3.2, which discussed the “life-cycle” and Recommendation 3.3 which referenced the “end of life.” He inquired whether “life-cycle” and “end of life” referred to chemicals or humans. Dr. Somasundaran responded that the “end of life” referred to the “end of life” of a particular chemical species. He stressed that Recommendation 3.3 urges that CSS maintains their focus on how these end effects will affect humans. Dr. Bahadori commented that the work mostly assesses the life cycle of consumer products.

Chemical Safety for Sustainability Program Comments

Tina Bahadori, CSS NPD

Dr. Bahadori stated that unlike the other programs, the CSS subcommittee did not review only a segment of the CSS program, but all four aspects of the program. Dr. Bahadori explained that the subcommittee reviewed more than ten projects in great detail. She reported that the subcommittee merged their meeting with the partnering scientists. At this joint meeting, more than 40 posters were presented in 3 days including seven interactive genius bars for educational outreach and to get feedback on tool performance. There were ten platform presentations that gave a panoramic view of all the topic areas and provided an opportunity for the BOSC members to interact with the presenters. Dr. Bahadori added that the CSS program had struggled to engage with EPA partners and regions in the past. Following BOSC’s recommendation, CSS built the partner engagement groups to train them on the science and provide opportunities for the program to provide feedback to the BOSC on areas for program improvement. Dr. Bahadori concluded by thanking the subcommittee for the productive and extensive feedback.

Discussion of Chemical Safety for Sustainability Subcommittee Draft Report

Deborah Swackhamer, Chair

Dr. Swackhamer asked Dr. Bahadori if she was concerned about any of the subcommittee’s recommendations. Dr. Bahadori responded that the spirit of the recommendations did not concern her, but she had reservations that several of the recommendations use the wording “develop.” She explained that CSS is not a biotechnology firm, but a small research group in a federal organization, and that it is not always possible to act on all recommendations. Dr. Swackhamer asked if there was a better word the subcommittee could use to frame their recommendations. Dr. Bahadori responded that regarding Recommendation 1.1, she would suggest broadening it, as it is one piece of the larger group of tools CSS currently uses. She provided the example of the Endocrine Disruptor Screening Program, where CSS has already shown the movement towards a more strategic approach as the program determines the way to reduce the number of critical assays. Therefore, she noted that, in isolation, the recommendations might cause a bit of challenge. Dr. Bahadori reiterated that she understood the message of the recommendations and that CSS has already begun implementing the suggested actions.

Dr. Frithsen commented that recommendations are most helpful when they are actionable and specific. He added that it would be helpful to have a sense of their priorities and time course (e.g., if the goal is a short-term versus a long-term goal) also. Lastly, he noted that it is helpful to know the goal of recommendation without being overly prescriptive in how it should be achieved.

Dr. Richardson suggested replacing informal phrases, such as “low-hanging fruit” and “build it here.” Dr. Swackhamer added that there is no text to support the “low-hanging fruit” recommendation, and it is not clear to what it refers. She suggested providing an example.

Ms. Smith stated that the subcommittee focused on three aspects of CSS research, but it was not clear how they were chosen. Dr. Somasundaran clarified that there were more than three aspects, but the three discussed in the Draft Report were those that the subcommittee thought were most important. Dr. Swackhamer asked how many programs were in the chemical evaluation research topic area. Dr. Bahadori noted that the subcommittee’s report is organized by topic as opposed to project. Although the Draft Report considers two projects, High-Throughput Toxicology and Rapid Exposure and Dosimetry, she clarified that the subcommittee also provided comments on the Integration and Mixtures aspect. Dr. Swackhamer suggested the addition of a table that displayed the organization, perhaps the table in the StRAP.

Dr. Kavlock commented that the recommendations are not tied to the charge questions and suggested reformatting the document.

Dr. Swackhamer requested clarification on the term “read-across,” wondering if the phrase “extrapolate” could be included parenthetically. Dr. Bahadori gave a brief summary and agreed that “extrapolate” could be included for clarification.

Dr. Swackhamer commented that Recommendation 3.4 was more of a compliment than a recommendation and asked the subcommittee to discuss it in the main text instead. Dr. Richardson noted Recommendation 3.2 was similar.

Dr. Swackhamer requested that Recommendation 4.1 be rewritten in active voice.

Dr. Swackhamer noted that “molecular initiating event (MIE)” was missing from the acronym list. She also pointed out that all acronyms should be defined in the text, not just the list.

Dr. Swackhamer then requested clarification on the first paragraph in the virtual tissues discussion on page 9. The text implied that CSS was responsive to previous comments, but then noted a gap (i.e., the limited use of tissue models). She asked whether this gap was noted in the previous review. Dr. Bahadori clarified that the comment referred to extramural research, adding that CSS had begun conducting organ modeling, but did not include tissue modeling. Dr. Swackhamer asked if it is a current gap, and Dr. Bahadori confirmed that due to budget constraints, it is. Dr. Swackhamer confirmed that the verb tense was correct.

Dr. Swackhamer commented on the discussion related to the CompTox dashboard on page 18 that says it “is likely to become a signature global product of CSS.” She stated her opinion that CompTox already is already a global tool. Dr. Bahadori clarified that it referred to the CompTox Chemistry Dashboard, which is new.

Dr. Swackhamer added that the language in the second paragraph under the sustainable chemistry subheading on page 16 was awkward. She asked if the Draft Review could say “modeling” where it said “Developing more rapid machine learning phased approaches...” Dr. Bahadori clarified that it referred to manual curation of data, adding that there are many ways to expedite the processing of data, of which machine learning tools is one.

Dr. Frithsen commented on the discussion about collaboration. He noted that collaboration is beneficial, but it requires investment and resources. When the purpose is known, the program can make better decisions and identify relevant success measures. He suggested noting the

specific goals of the collaborations in all Draft Reports. Dr. Chaudhry replied that in most cases, the subcommittee recommended collaboration to extend the program's research dollars. He clarified the need to rephrase the text so it emphasizes that these collaboration efforts should be continued. Dr. Swackhamer agreed, and noted that engagement can be extended beyond collaboration to include consultations, one-way information deliveries, and other exchanges depending on the research phase.

Dr. Swackhamer summarized the changes to the CSS Draft Report, noting that it is well-written and a good model for the other subcommittees:

- The text requires wordsmithing to clarify details discussed above.
- Jargon should be removed.
- The recommendations should be organized by charge question.
- The recommendations should also be prioritized and indicated as short- or long-term, without reference to “investments.”
- Suggested collaborations should be clearly defined.

Friday, January 13, 2017

Air, Climate, and Energy Subcommittee Draft Report

Viney Aneja, Chair; Sandra Smith, Vice Chair

Dr. Aneja acknowledged the contributions from the Vice Chair, Ms. Smith, and the ACE subcommittee. Dr. Aneja reviewed the ACE subcommittee's membership and gave a brief overview of their process. Dr. Aneja also read the subcommittee's charge questions (see Appendix C for the full list).

Ms. Smith noted they were first asked to identify the strengths of the ACE program conceptual model. The subcommittee found the conceptual model to be rich in detail, thoughtful, and thought provoking. The conceptual model carefully considered best practices of interdisciplinary collaboration and was responsive to the directive. The conceptual model also emphasized building networks, recognized the importance of a team facilitator, and presented the value of using various logic flow diagrams throughout the problem formulation stage. Ms. Smith explained the conceptual model acknowledged the need for dedicated funding and personnel for interdisciplinary research, identifying and cataloging newly available tools important for implementation of the model, and codifying the process for interdisciplinary research that focuses on facilitation and consensus-building. The subcommittee felt this model could be used across the Agency.

Ms. Smith then explained the subcommittee was asked to identify the conceptual models' weaknesses. The subcommittee noted a missed opportunity to recommend early action to actively identify and develop a cadre of team facilitators specifically trained to lead integrated social-natural science projects. She noted these individuals might not be social scientists, but individuals who are part of the social science exchange network or who have training in the social sciences. The second weakness was that the conceptual model described building a large network of social science experts both within and outside EPA, but lacked detail on the anticipated role of the network. Ms. Smith stated the network is still evolving, but impressively already includes 200 active members. She also pointed out a lack of detail regarding mechanisms for review and modification.

Ms. Smith then discussed the subcommittee's recommendations and clarified she highlighted the ones that the group felt were the strongest and actionable. Ms. Smith discussed three recommendations related to Charge Question 1. Recommendation 1 asked ACE to provide specific examples related to how the conceptual model would integrate social sciences into the ACE program and could be applied to other programmatic areas of EPA. Recommendation 2 suggested that ACE include details related to how the program will facilitate building networks of social and natural scientists and engineers. Ms. Smith stated the subcommittee recommended that ACE specify which approaches would be most important in enhancing the development of interdisciplinary research that addresses those environmental issues that are at the core of the Agency's mission. Recommendation 3 suggested that the program clarify the importance of iterative steps that will refine the model application. The subcommittee recommended the program further indicate how the Agency would support the cultural shift toward this interdisciplinary approach both within ACE and across EPA more broadly.

The first of the three recommendations related to Charge Question 2 suggested ACE develop guidelines for problem formulation and evaluation. As the problem formulation workshops are piloted, ACE should document the process, which will enable the program to evaluate its success and others to replicate their method. The second recommendation suggested that ACE develop and apply new incentives and performance evaluation structures that align with its social science priorities. The third recommendation included evaluating budgetary and staff tradeoffs related to the shift toward social science-focused research.

Related to Charge Question 3, the first recommendation suggested that ACE rely on methods previously developed by other federal agencies. The second recommendation suggested ACE incentivize researchers to engage and present at interdisciplinary conferences. Ms. Smith noted the recommendation could be achieved through publicizing a wider range of conferences within ACE and providing supplemental travel funds specifically targeting staff participation at selected interdisciplinary conferences. The last recommendation was aimed at creating new avenues with appropriate incentives to expose ACE researchers to interdisciplinary projects (e.g., conferences, in-house seminars, and informal collaborations). Ms. Smith acknowledged that ACE should continue doing what they are doing.

Air, Climate, and Energy Program Comments

Alan Vette, ACE Deputy NPD

Dr. Alan Vette expressed his gratitude to the subcommittee for addressing such a challenging issue. He noted that although ACE ultimately supported and agreed with the subcommittee's recommendations, he sought clarification on several details. Dr. Miller clarified that the program had several comments related to the details and wording surrounding metrics and incentives. As written, the phrasing would have certain implications, but they agreed with the intent of the recommendations.

Discussion of Air, Climate, and Energy Subcommittee Draft Report

Deborah Swackhamer, Chair

Related to Charge Question 1, Dr. Vette reiterated the subcommittee suggestion to implement an appropriately designed reward structure. He noted the specific examples listed could be achieved, assuming the availability of travel funds. ACE intends to provide the necessary encouragement, support, and funding, where possible, into individual projects to support the

integration of social science. Dr. Vette remarked it only becomes problematic if the recommendation is tied to metrics of job performance.

Dr. Swackhamer explained that an “appropriately designed reward structure” gives SHC the opportunity act as they deem fit. She explained that the recommendations should not be too prescriptive and asked for clarification on any language that might be. Dr. Hubbell commented that ACE can utilize rewards beyond individual rewards and noted that this discretion would be helpful.

Ms. Smith thanked Dr. Vette and Dr. Miller for their feedback. She clarified that the subcommittee was not aware of the difficulty to change performance criteria. She stated it might be helpful for the subcommittee to hear about why social scientists are or are not joining the social science network. Dr. Hubbell responded that there is a desire to ensure that people will not lose ground by taking part in an interdisciplinary project. He explained that these projects usually take longer and there are fewer opportunities to receive recognition in ways that are meaningful in their professional fields and during performance reviews.

Dr. Vette commented that over the past 5 to 6 years, ACE has increased its emphasis on transdisciplinary research with larger project teams. He explained that many concerns were expressed regarding the impact on promotion potential. Researchers are promoted through the technical qualification board, which is rigidly structured and has a heavy emphasis on the number of first-author publications. He noted that as they moved into larger project teams, this was emphasized less. Dr. Aneja commented that the spirit of the recommendation was that transdisciplinary work should be recognized, and the subcommittee understands ACE has a more complete understanding of the portfolio of awards at their disposal. Dr. Vette asked Dr. Hubbell about the role of the social science network. Dr. Hubbell responded that the network is internal to EPA, but he hopes to eventually bring in expertise from academic communities and other federal partners. He explained that the network is focused on the education component currently. He also discussed the facilitated dialogues which help environmental scientists who do not have a full understanding of social science. These are an opportunity for the scientists to articulate questions about social and environmental problems and receive recommendations related to methods, tools, and models that might be useful for their research.

Dr. Olsiewski asked if there is funding for activities besides workshops that inspire interdisciplinary discussions and foster collaborations. Dr. Hubbell responded all meetings are virtual. He explained he is working toward a workshop for translational science that will focus on using social sciences to understand community needs and translating that understanding into action.

Dr. Swackhamer noted that under the “Weakness and Suggestions” section, the Draft Report states “the exact role of the network is not clear.” She noted that the previous discussion clarified this point. She further noted that the Draft Report asked “will [the network] formulate the research questions and hypothesis? Will they also be part of the research team?” She clarified that the network is a group of individuals, not a new research group.

Regarding the recommendation for Charge Question 2 which states “develop guidelines for problem formulation and evaluation,” Dr. Swackhamer asked for clarification on who should complete that work. Dr. Hubbell commented that ACE is facilitating the addition of social science into the centers’ and laboratories’ portfolios, but they are not creating a new research

program of their own. He clarified that the network will not impose research questions, but the individuals involved in the network they can help others develop theirs.

Dr. Swackhamer suggested the third bullet to that recommendation be changed to connote it is a strength, “the skills marketplace facilitates identification of staff with social science expertise,” adding that she did not want the phrasing to imply that the subcommittee considered the network a weakness. Dr. Rubin suggested capturing the network as an emerging strength.

Dr. Richardson remarked there the Draft Report contained text supporting Charge Question 2, but pointed out that he could not identify a direct recommendation. He added that EJ was not mentioned, and air quality sensors could be used to address certain problems. Dr. Richardson stated the recommendations seem to stray from the specific nature of the charge questions. Dr. Richardson suggested that specific statements and recommendations be included. Ms. Smith agreed and explained the subcommittee planned to make more direct connections, if possible, to ensure alignment with the charge questions.

Dr. Aneja agreed with Dr. Richardson and noted that the subcommittee discussed these issues. He explained that there was a discussion about sensors, not just in the United States, but in the embassies as well. The subcommittee felt that the workshops to follow would provide more clarity of the projects EPA might be address. Furthermore, the subcommittee wanted to provide ACE the opportunity to provide additional related guidance.

Dr. Swackhamer directed attention to the discussion of Charge Question 2 on page 9, “regarding potential applications in the climate domain, the 2016 Climate Roadmap assesses how EPA is currently or could in the future address the myriad ways in which climate change will impact EPA’s mission to protect the environment and human health.” She stated that she expected to see the following in the recommendation: “we encourage EPA to develop additional pilot studies related to climate impacts, adaptation, and/or mitigation, and preferably involving two or more of these broad topics.” Without the additional text, the statement should be moved to the main text. She suggested that the subcommittee omit the recommendations related to incentives because they are addressed under Charge Question 1. Finally, Dr. Swackhamer added that she did not see much discussion of Charge Question 2 as it relates to the guidelines for problem formulation and evaluation. Dr. Hubbell replied the Draft Report touched on ACE’s documentation of their workshops to assist in the evaluation of problem formulation exercises.

With respect to sensors, Dr. Vette explained there are key areas within the program where social sciences could be integrated. Air sensors seemed like a natural place to start because of citizen-science and EJ issues. Dr. Hubbell added that ACE only provided the subcommittee with the *Environmental Health Perspectives* paper related to this, and it might not have adequately reflected the extent of ACE’s work in that area.

Regarding the last bullet about documenting decision making as it relates to tradeoffs, Dr. Miller clarified that ACE does this on a routine basis, but he would be concerned if the program was expected to document every decision. ACE is engaged in multiple discussions across the program. He noted that there is concern about priorities and tradeoffs, but how ACE documents these details is a different question. ACE would need specific guidance on what the subcommittee expects in response. Ms. Smith responded that the subcommittee recognized that they might not have received all of the necessary information, and that certain work will likely lose emphasis as other work is increasingly emphasized. Dr. Swackhamer noted that on page 10, there was appropriate discussion about that issue, and suggested moving the discussion to the

main text. She then noted the use of “adding staff” in the second sentence and suggested using “utilize staff” as an alternative. Dr. Hubbell noted that the discussion on social science expertise versus social scientists would give ACE the ability to determine how to add the expertise.

Dr. Miller pointed to the suggestion to conduct cost benefit analyses on page 10 and explained that he does not think ACE could quantify the benefits. ACE can, however, provide a discussion of what the benefits are and why they are important. Dr. Swackhamer suggested changing the language to “a more robust evaluation.”

Dr. Vette commented that integrating social sciences into the program is not something that ACE is taking lightly. He explained that ACE sees it as a natural progression of natural science research, whether or not the results can be quantified in the short term. ACE is doing this in a judicious manner, looking for key opportunities where the program can add the most value by integrating social science.

Dr. Aneja commented that when the subcommittee deliberated this issue, they discussed whether there is an optimal point where ACE could determine whether adding social science would lead to some level of advancement in the projects. He added that the benefits do not have to be monetized, and he does not think ACE should interpret the language as asking for a dollar value. Dr. Swackhamer suggested editing the Draft Report to reflect that sentiment.

Dr. Miller urged the group to remember that the current discussion overemphasizes the focus on social sciences. He added that there are many areas where ACE only operates in the core physical and biological sciences. The integration effort is related to finding ways to translate the basic science research findings into improved environmental outcomes. He noted that these are all pilot efforts and finding an “optimum point” is not the current goal. Dr. Hubbell clarified that the goal of the overarching conceptual model is to reflect that the highest value of social science integration is to amplify the core work, not replace it.

Dr. Vette commented on the first recommendation under Charge Question 3. ACE agreed with the spirit of the recommendation, but noted it would not be easy to implement. Ms. Smith clarified that the subcommittee did not intend for ACE to develop the metrics, but rather build off of metrics that have been developed by other federal agencies. Dr. Swackhamer encouraged the subcommittee to change the related language to clarify their point. Dr. Miller asked for clarification regarding whether the metrics are to focus on data quality assurance or performance and success. Ms. Smith responded that it was a broad recommendation to facilitate the evaluation of the success of the program. Dr. Swackhamer suggested that the subcommittee edit the recommendations so they are actionable.

Dr. Swackhamer reviewed the edits to the ACE Subcommittee Draft Report:

- Confirm all references to “EPA” should not be references to “ACE.”
- Reorganize the text so the details related to the recommendations for Charge Questions 2 and 3 are proximate to the charge questions.
- Remove language related to job performance criteria.
- Expand the direct mention of sensors as a pilot as a recommendation and include connections to EJ.

Summary and Next Steps

Deborah Swackhamer, Chair

Dr. Swackhamer discussed the EC's next steps. First the subcommittee Chairs and Vice Chairs will revise their Draft Reports.

Next, she informed the EC that the HS subcommittee is scheduled to meet February 14-16, 2017, and proposed that the EC schedule a conference call in March, 2017 to discuss the HS Draft Report and the rest of the subcommittee's revised Draft Reports.

She encouraged the use of a standard organizational structure in the subcommittee Draft Reports, noting that the CSS Draft Report is an appropriate model. Specifically, the recommendations should be in bold font and embedded within the report.

Dr. Swackhamer underscored the importance of completing the final report by April 2017, as EC membership will change at that point in time.

Ms. Smith requested clarification on the process of involving the subcommittee members in making the revisions. Dr. Swackhamer responded that the Chair and Vice Chair should distribute the new version to the rest of the subcommittee and, if substantial changes are made, explain that the edits were made at the request of the EC and request approval. Dr. Richardson noted that the SHC subcommittee planned to send the revised report to the DFO with a summary of the EC discussion related to the changes, who will then ask the subcommittee members to report any major objections. Dr. Swackhamer commented that sounded like a good process for the SHC subcommittee, but acknowledged it might not work for all subcommittees.

Dr. Chaudhry asked if the subcommittee Chairs could share the EC's comments with the subcommittee members. Mr. Tracy replied that they can, but encouraged the members not to exchange emails discussing the comments; the subcommittee members can reply to Chair, Vice Chair, and DFO, but they cannot reply to the full subcommittee due to FACA requirements.

Dr. Swackhamer stated that the revisions to the subcommittee Draft Reports should be submitted to Mr. Tracy by February 13, 2017.

Related to metrics and program evaluation, Dr. Swackhamer reiterated the need to build a catalogue of metrics that will be useful for future BOSC reviews. She encouraged the EC members to reflect on what data or evidence would have helped them to write their reviews and to send their ideas to Mr. Tracy. She also stated that the four EC members who volunteered to lead the performance evaluation subgroup should compile the recommended metrics, and, subsequently, the EC will draft a separate summary report to deliver to ORD.

Dr. Swackhamer asked the EC how to proceed on the social sciences topic. Dr. Richardson replied that the planned activities have ended, and there are no expectations forthcoming. He added that he and Dr. Flint have agreed to consult with Dr. Hubbell as it is useful, but no specific responsibilities remain. Dr. Swackhamer inquired whether there is a plan to finalize the workshop report. Dr. Richardson replied he plans to suggest minor revisions, but that is the end of the process. Dr. Swackhamer asked what role the BOSC could play in continuing to support the integration of social sciences. Ms. Smith noted the value of having of Dr. Hubbell in attendance at the ACE Subcommittee meeting, adding that many subcommittee members gained important insight. She suggested that other subcommittees might benefit from similar interactions.

Dr. Miller thanked the EC on behalf of ORD. He stated the feedback was tremendously valuable and the interactions were appreciated.

Wrap-up and Adjourn Public Meeting

Thomas Tracy, DFO

Mr. Tracy and Dr. Swackhamer adjourned the meeting.

Appendix A: Agenda

**United States Environmental Protection Agency
Board of Scientific Counselors (BOSC)
Executive Committee**

Meeting Agenda – January 11–13, 2017
Durham, North Carolina

Breaks at the discretion of the Chair.

**Wednesday, January 11, 2017 – Deliberation on Research Roadmap Annual Reports,
Discussions on Program Evaluation and Metrics and on Social Science**

9:00 a.m.	Convene Meeting	Thomas Tracy Designated Federal Officer
9:10 a.m.	Welcome	Thomas Burke Deputy Assistant Administrator Robert Kavlock Deputy Assistant Administrator for Science
9:30 a.m.	Introduction of Members	Deborah Swackhamer, Chair
9:45 a.m.	Review Agenda, Meeting Charge, and Process	Deborah Swackhamer, Chair
10:05 a.m.	Public Comments	Registered Speakers

Deliberation on Research Roadmap Annual Reports

10:20 a.m.	Presentation: Draft Report on Environmental Justice Annual Report	Courtney Flint
10:40 a.m.	Roadmap Lead Comments	Andrew Geller, Roadmap Lead Environmental Justice Roadmap
10:50 a.m.	Discuss Draft Report on Environmental Justice Annual Report	Deborah Swackhamer, Chair
11:00 a.m.	Break	
11:15 a.m.	Presentation: Draft Report on Children’s Environmental Health Annual Report	Gina Solomon
11:35 a.m.	Roadmap Lead Comments	John Cowden, Roadmap Lead Children’s Environmental Health Roadmap
11:45 a.m.	Discuss Draft Report on Children’s Environmental Health Annual Report	Deborah Swackhamer, Chair

11:55 a.m.	Lunch	
1:00 p.m.	Presentation: Draft Report on Climate Change Annual Report	Robert Richardson
1:20 p.m.	Roadmap Lead Comments	Andy Miller, Roadmap Lead Climate Change Roadmap
1:30 p.m.	Discuss Draft Report on Climate Change Annual Report	Deborah Swackhamer, Chair
1:40 p.m.	Presentation: Draft Report on Nitrogen & Co-pollutant Annual Report	James Galloway
2:00 p.m.	Roadmap Lead Comments	Anne Rea, Roadmap Lead Nitrogen & Co-pollutant Roadmap
2:10 p.m.	Discuss Draft Report on Nitrogen & Co-pollutant Annual Report	Deborah Swackhamer, Chair
2:20 a.m.	Break	

Discussion on Program Evaluation and Metrics

2:35 p.m.	Presentation on Program Evaluation and Metrics	Monica Linnenbrink, ORD
3:20 p.m.	Discussion on Program Evaluation and Metrics	Deborah Swackhamer, Chair

Discussion on Social Science

4:30 p.m.	Presentation on Social Science	Bryan Hubbell, ORD
5:05 p.m.	Discussion on Social Science	Deborah Swackhamer, Chair
6:00 p.m.	Adjourn	Deborah Swackhamer, Chair

Thursday, January 12, 2017 – Discussion on Subcommittee Draft Reports and Lab Tour

8:30 a.m. Reconvene Deborah Swackhamer, Chair

Deliberation on BOSC Subcommittee Draft Reports

8:35 a.m. Safe and Sustainable Water Resources Subcommittee Draft Report Joseph Rodricks, Chair
Shahid Chaudhry, Vice Chair

8:55 a.m. SSWR Program Comments Suzanne van Drunick
National Program Director

9:15 a.m. Discussion: SSWR Subcommittee Draft Report Deborah Swackhamer, Chair

10:15 a.m. Break

10:30 a.m. Sustainable and Healthy Communities Subcommittee Draft Report Robert Richardson, Chair
Courtney G. Flint, Vice Chair

10:50 a.m. SHC Program Comments Andrew Geller
National Program Director, Acting

11:10 a.m. Discussion: SHC Subcommittee Draft Report Deborah Swackhamer, Chair

12:10 p.m. Lunch

1:15 p.m. Chemical Safety for Sustainability Subcommittee Draft Report Ponisseril Somasundaran, Chair
Gina Solomon, Vice Chair

1:35 p.m. CSS Program comments Tina Bahadori
National Program Director

1:55 p.m. Discussion: CSS Subcommittee Deborah Swackhamer, Chair

2:55 p.m. Adjourn Deborah Swackhamer, Chair

3:00 p.m. Break

Lab Tour

3:15 p.m. Lab Tour

5:00 p.m. Conclude Lab Tour

Friday, January 13, 2017 – Deliberation on BOSC Subcommittee Draft Report and Closed Administrative meeting

8:30 a.m. Reconvene Deborah Swackhamer, Chair

Deliberation on BOSC Subcommittee Draft Report

8:35 a.m. Air, Climate and Energy Subcommittee Draft Report Viney Aneja, Chair
Sandra Smith, Vice Chair

8:55 a.m. ACE Program Comments Dan Costa
National Program Director

9:15 a.m. Discussion: ACE Subcommittee Draft Report Deborah Swackhamer, Chair

10:15 a.m. Break

10:30 a.m. Summary and Next Steps Deborah Swackhamer, Chair

11:00 a.m. Adjourn Public Meeting Thomas Tracy
Designated Federal Officer

Closed Administrative meeting

11:05 a.m. Administrative Meeting Deborah Swackhamer, Chair
Close meeting Robert Kavlock
Deputy Assistant Administrator for Science

11:55 a.m. Working Lunch

1:00 p.m. Adjourn Deborah Swackhamer, Chair

Appendix B: Participants

BOSC Executive Committee Members:

Deborah L. Swackhamer, Chair

Viney Aneja

Shahid Chaudhry

Susan E. Cozzens

Courtney Flint

James N. Galloway

Earthea A. Nance^

Paula Olsiewski

Diane E. Pataki^

Robert Richardson

Joseph Rodricks^

I. Leslie Rubin

Sandra Smith

Gina Solomon*

Ponisseril Somasundaran

Tammy Taylor

John P. Tharakan*

^ *did not attend*

* *participated via phone/webinar*

EPA Designated Federal Officer (DFO): Thomas Tracy, *Office of Research and Development*

EPA Presenters:

[Some presenters' titles have changed.]

Thomas Burke, *Office of Research and Development, Deputy Assistant Administrator*

Robert Kavlock, *Office of Research and Development, Deputy Assistant Administrator for Science*

Suzanne van Drunick, *Office of Research and Development, National Program Director for the SSWR Research Program*

Andrew Geller, *Office of Research and Development, Deputy National Program Director for the SHC Research Program, Roadmap Lead for the Environmental Justice Roadmap*

Michael Slimak, *Office of Research and Development, SHC Research Program*

Tina Bahadori, *Office of Research and Development, National Program Director for the CSS Research Program*

John Cowden, *Office of Research and Development, Deputy National Program Director for the CSS Research Program, Roadmap Lead for the Children's Environmental Health Roadmap*

Monica Linnenbrink, *Office of Research and Development, Communications Director, National Center for Computational Toxicology*

Bryan Hubbell, *Office of Research and Development, Senior Advisor for Science and Policy Analysis, Office of Air Quality Planning and Standards*

Anne Rea, *Office of Research and Development, Roadmap Lead for Nitrogen & Co-pollutant Roadmap*

Andy Miller, *Office of Research and Development, Associate National Program Director for the ACE Research Program, Roadmap Lead for the Climate Change Roadmap*

Other EPA Attendees:

Kirk Baker	Alan Hecht*	Jennifer Richmond-Bryant
Tim Benner*	Ron Hines	Gail Robarge*
William Benson	Erin Hines	Bruce Rodan
Serena Chung*	Leif Hockstad*	Kathryn Saterson*
Sam Cohen*	Julie Hyman*	Laurel Schultz
Elaine Cohen Hubal	Christopher Impellitteri*	Donna Schwede*
John Cowden	Annie Jarabek	Mya Sjogren*
Jace Cuje*	Jacques Kapuscinski*	Emily Snyder
Rebecca Daniels*	Nicole Kim	Salina Tewolde*
Melissa Day*	Mike Kryak	Kris Thayer*
Sean Dowd*	Michelle Latham*	Rusty Thomas*
Emily Eisenhauer*	Sarah Mazur*	John Vandenberg
Jill Franzosa	Melissa McCullough	Alan Vette
Jeffrey Frithsen	Susan Norton*	Chris Weaver*
Rick Greene*	Jennifer Orme-Zavaleta	Linda Williams*
Maureen Gwinn	Beth Owens*	Joe Williams
Intaek Hahn	Sean Paul*	Benjamin Zukowski
Beth Hassett-Sipple	Viktoriya Plotkin	

**participated via phone/webinar*

Contractor Support:

Canden Byrd, ICF

Ali Goldstone, ICF

Catherine Smith, ICF

Appendix C: Charge Questions

Charge for the Environmental Justice Roadmap

Charge Question 1: Comment on areas of successful integration and implementation as articulated in the related Roadmap. This may include, but is not limited to, the following:

- Levels of commitment to Roadmap recommendations as incorporated into the ORD StRAPs;
- Coordination across ORD's six National Research Programs;
- Communication and outreach to partners and stakeholders; and
- Areas of innovation

Charge Question 2: Provide suggestions for improving implementation of the roadmaps and research integration across the National Research Programs.

- Are there additional opportunities for implementation or integration not highlighted in the annual report?
- Does "The Year Ahead section" adequately describe the next steps and short-term research areas and commitment?

Charge for the Children's Environmental Health Roadmap

Charge Question 1: Comment on areas of successful integration and implementation as articulated in the related Roadmap. This may include, but is not limited to, the following:

- Levels of commitment to Roadmap recommendations as incorporated into the ORD StRAPs;
- Coordination across ORD's six National Research Programs;
- Communication and outreach to partners and stakeholders; and
- Areas of innovation

Charge Question 2: Provide suggestions for improving implementation of the roadmaps and research integration across the National Research Programs.

- Are there additional opportunities for implementation or integration not highlighted in the annual report?
- Does "The Year Ahead section" adequately describe the next steps and short-term research areas and commitment?

Charge for the Climate Change Roadmap

Charge Question 1: Comment on areas of successful integration and implementation as articulated in the related Roadmap. This may include, but is not limited to, the following:

- Levels of commitment to Roadmap recommendations as incorporated into the ORD StRAPs;
- Coordination across ORD's six National Research Programs;
- Communication and outreach to partners and stakeholders; and
- Areas of innovation

Charge Question 2: Provide suggestions for improving implementation of the roadmaps and research integration across the National Research Programs.

- Are there additional opportunities for implementation or integration not highlighted in the annual report?
- Does “The Year Ahead section” adequately describe the next steps and short-term research areas and commitment?

Charge for the Nitrogen and Co-pollutant Roadmap

Charge Question 1: Comment on areas of successful integration and implementation as articulated in the related Roadmap. This may include, but is not limited to, the following:

- Levels of commitment to Roadmap recommendations as incorporated into the ORD StRAPs;
- Coordination across ORD’s six National Research Programs;
- Communication and outreach to partners and stakeholders; and
- Areas of innovation

Charge Question 2: Provide suggestions for improving implementation of the roadmaps and research integration across the National Research Programs.

- Are there additional opportunities for implementation or integration not highlighted in the annual report?
- Does “The Year Ahead section” adequately describe the next steps and short-term research areas and commitment?

Charge for the BOSC ACE Subcommittee

Charge Question 1: The ACE program has developed a conceptual model for interdisciplinary research that brings together social and environmental sciences to address significant environmental challenges within the ACE research program. What are the strengths and weaknesses of this model in guiding ACE toward a more integrated social-environmental research program?

Charge Question 2: The ACE program is piloting several applications of the conceptual model, including an interdisciplinary problem formulation workshop on wildfire smoke risk communication and management that took place in September 2016. How can the ACE program make this approach more widely applicable to other aspects of the program such as 1) the Climate Roadmap and 2) distributed data collection, e.g., social and economic impacts of air quality sensors?

Charge Question 3: What are other viable, near-term opportunities for integrating social sciences, either within the ACE program or jointly with other ORD research programs, that warrant discussion?

Charge for the BOSC SHC Subcommittee

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?

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

Charge for the BOSC SSWR Subcommittee

Charge Question 1: Are we doing the right research: Taking resource limitations into consideration, is there any additional research that warrants new investment or current research that merits expansion, and are there areas of research that SSWR may consider divesting in?

Charge Question 2: Are we doing the right research at the right time? Comment on the balance of near, current and long-term research objectives.

Charge for the BOSC CSS Subcommittee

Charge Question 1: Science: Are we doing the right research? Taking resource limitations into considerations, are there any significant scientific gaps?

Charge Question 2: Integration: Based on prior feedback from this Subcommittee, over the past year, CSS has focused on further integrating the program within and between projects. Please comment on the progress. Is the integration approach right? Are there other areas that should be enriched?