U.S. Environmental Protection Agency Board of Scientific Counselors

Executive Committee

Teleconference Minutes

November 1, 2016

Meeting Minutes

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

Contents

Convene Meeting

Thomas Tracy, Designated Federal Officer

Mr. Thomas Tracy, the U.S. Environmental Protection Agency (EPA) Designated Federal Officer (DFO) for the Board of Scientific Counselors (BOSC) Executive Committee (EC), formally opened the meeting and welcomed the committee members. He discussed the Federal Advisory Committee Act (FACA) stipulations governing the meeting, which requires that the meeting is open to the public and that there must be time reserved for public comments. Mr. Tracy conducted roll call and turned the meeting over to Dr. Robert Kavlock, who is the Agency's Deputy Assistant Administrator for Science and oversees the Agency's national research programs.

Welcome

Robert Kavlock, Deputy Assistant Administrator for Science

Dr. Kavlock introduced himself and thanked the EC members for their participation. He noted that BOSC activity is in full swing, and most of the research program reviews will be complete by mid-November. He reminded the participants that the purpose of this meeting was to review and approve the final two research program roadmaps. Other updates will help focus the conversation during the January 2017 EC face-to-face meeting.

Introduction of Members and Review of Agenda

Deborah Swackhamer, Chair

Dr. Deborah Swackhamer introduced herself and three EC members who are either new to the committee or have new roles: Dr. Joe Rodricks, Dr. Susan Cozzens, and Dr. Elizabeth Corley. She welcomed the EC members and thanked them for their participation. She reviewed the agenda. The EC members will discuss the work related to social science and metrics that will be undertaken, hear briefings on the annual reports, and discuss what the members would like to accomplish ahead of the January meeting.

Public Comments

Registered Speakers

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

Update on Social Science Integration

Robert Richardson and Courtney Flint

Dr. Robert Richardson opened the discussion by introducing the recent activities in which he and Dr. Courtney Flint have been involved related to the integration of social science into environmental science and policy. Dr. Richardson focused the presentation on two recent events. He noted a recent half-day meeting, organized by the Office of Policy, which sought to bring together program leads and administrators from various offices throughout the Agency to discuss the topic of social science. Second, Dr. Richardson highlighted the 2-day social science

workshop held in Research Triangle Park in October 2016 that he and Dr. Flint organized. The objective of this workshop was to introduce the concepts of social science to scientists from throughout the Agency's Office of Research and Development (ORD). The first portion of the workshop introduced the key concepts, tools, methods and theories of behavioral and social sciences. The remainder of the workshop focused on two half-day case studies, which aimed to demonstrate the value of the social sciences in the context of environmental science and policy. The first case study focused on the social dimensions of water systems, and presenters introduced several examples of research applications and tools used to investigate drinking water quality disparities. The second case study concentrated on the social dimensions of environmental contamination and remediation. Dr. Richardson summarized that the second case study touched on research examples including applications from participatory social sciences and analyses of the social and economic impacts of remediation.

Dr. Courtney Flint continued by recalling the discussion during the December 2015 EC meeting regarding the need for greater consideration of social science. She noted that at the end of that meeting, the members felt a great deal of uncertainty regarding how and where social science could be integrated into the ORD programs. She explained that the aim of the October 2016 social science workshop was not only to provide an overview of social sciences to workshop participants, but to highlight examples of ongoing work from interdisciplinary teams drawing from economics, sociology, psychology, behavioral sciences, geography, and other fields. Orientation and case study material at the workshop was organized around six general propositions about social science: 1) society is vertically and horizontally organized, 2) people make choices, 3) attitudes do not necessarily match behaviors, 4) context matters, 5) environmental quality is not distributed equitably, 6) framing matters and issues of communication can impact perception and response. Dr. Flint expressed her satisfaction with the workshop overall and praised the productive and involved exchange between ORD participants regarding the issues of social science integration throughout the Agency.

Dr. Swackhamer asked if there were any written outputs from the conference that could be distributed to the EC members before the January meeting. Dr. Flint explained that she has not yet published the workshop white paper, and that the best sources for additional material are the slides shared with EPA and the summary blog post. Dr. Flint asked Mr. Tracy to help facilitate the distribution of these materials to the EC members.

Dr. Kavlock conveyed his satisfaction with the lively discussions that took place during the October 2016 social science meeting. He explained that the number of attendees was capped at 50 to facilitate deeper discussions, but noted that more than 100 people participated online for the tutorial, which indicated a good permeation into ORD. Dr. Kavlock mentioned that he asked the National Program Directors (NPDs) to review their projects to identify areas which could benefit from additional engagement with the social sciences by mid-December 2016. The goal of this task is to identify a set of examples where the research planning process can more effectively incorporate the social science perspective. Dr. Kavlock stressed that ORD is views social science

as an important topic and is looking forward to discussing the NPD's responses with the EC members at the January 2017 meeting.

Dr. Swackhamer thanked Dr. Kavlock for his perspective and expressed her excitement about the ongoing discussions related to the integration of social science throughout the Agency. Dr. Swackhamer asked the EC members for clarifying questions for Dr. Flint, Dr. Richardson, or Dr. Kavlock.

Dr. John Tharakan asked if Dr. Flint and Dr. Richardson will be publishing a white paper, as it could be useful to frame the issues for the EC. Dr. Flint clarified that she hopes to produce a white paper, but it was not part of the charge so there is no definite timeline. Dr. Kavlock added that the group had also discussed drafting a journal manuscript which could then be developed into a white paper, but he reiterated that they have not discussed the timeline.

Dr. Joseph Rodricks commented on the long history of the involvement of social sciences in risk analysis process, particularly in risk perception and communication. He asked if these issues were considered at the social science workshop. Dr. Richardson explained that the topic was briefly discussed in the context of particular research examples; however, he noted that given the breadth of the task and the short time period, there is still a need to investigate this topic further.

Dr. Flint further stressed that social science work is already underway throughout the ORD, particularly as it relates to risk assessment and economic evaluations. She clarified that the goal of her work with Dr. Richardson was to increase general understanding and appreciation for the role of social science in environmental science and policy and to focus the conversation around core themes and core examples.

Introduction of Research Program Evaluation and Metrics

Susan Cozzens and Elizabeth Corley

Dr. Cozzens gave a high-level introduction to the topic of research program evaluation by explaining that these evaluations assess achievements in the context of program goals, taking into account the quality, relevance, and impact of the work. These evaluations draw on systematic information on outputs, immediate outcomes, and long-term outcomes or impacts, which are interpreted by subject matter experts. She also briefly described the legislative history that has driven federal agencies to evaluate their programs.

She also gave an overview of logic models, which are a tool for organizing an evaluation and focus on: inputs, activities, outputs, intermediate outcomes, and outcomes/impacts. Dr. Cozzens stressed that intermediate outcomes and outcomes/impacts are harder to track and are typically described using specific examples of success stories.

Dr. Cozzens described a number of emerging tools that are available and can improve the evaluation of research programs. She noted that the EC may consider these in their discussion during the January meeting.

Dr. Elizabeth Corley pointed out that it is also important to consider critical concepts that may not be captured easily in an evaluation. She also noted that consistency is important, and the EC should consider how to deal with differences in data availability across research programs. Finally, she added that the EC is in a unique position to think critically about what types of social science data are key to evaluations and recommend the programs collect such information moving forward.

Dr. Swackhamer asked the EC members for clarifying questions.

Dr. John Cowden pointed out that Agency impacts include the prevention of morbidity and mortality. He asked how evaluations may measure those types of impacts. Dr. Cozzens replied that, rather than pointing to the reduction or prevention statistics themselves, the research program can consider specific advances that were made based on EPA research. An example could be tools or databases made available to public health or health care professionals, which illustrate the effectiveness of intermediate outcomes based on Agency research. She added that success stories may also play an important role in tracking impacts through the entire causal chain.

Another member asked whether the evaluations consider return on investments, such as man-hours. Dr. Cozzens responded that most of those concerns would be addressed in the evaluation of input metrics. She added that well-thought out logic models aid in the identification of metrics that will reflect realistic impacts.

Dr. Kavlock noted that program and regional staff often highlight what they feel to be their own successes. He asked if this would be perceived as biased testimonials. Dr. Cozzens replied that an evaluation committee can use all bodies of knowledge.

Ms. Sandra Smith asked for clarification on the final bullet point related to outcomes and impacts: "changes in human health or the environment are outside the sphere of influence or control of EPA research programs." Dr. Cozzens replied that point is intended to refer to the macro-level influences (e.g., the regulatory environment, world economic markets, etc.) on health and the environment.

Chemical Safety for Sustainability (CSS) Program Metrics

Monica Linnenbrink, ORD

Dr. Kavlock introduced Ms. Monica Linnenbrink, who gave an update on the ongoing pilot research project that is measuring the impact of EPA's computational toxicology (CompTox) research program. Dr. Kavlock explained that recent efforts have been investigating novel metrics – including new social media tools – for program evaluation.

Ms. Linnenbrink began the presentation by providing a brief history of the Agency's CompTox research effort, explaining that the program was started in 2005 and has helped develop approaches for evaluating potential health effects of numerous chemicals. Ms. Linnenbrink explained that the purpose of this pilot project is to track metric trends to showcase the impacts

of research efforts. Ms. Linnenbrink stated that the ultimate desire is to broadly apply these methods of evaluation to multiple organizational levels, including EPA's Chemical Safety for Sustainability research program.

Ms. Linnenbrink highlighted the four main outputs that are produced by the EPA CompTox research program: 1) scientific publications and presentations, 2) research data, 3) software applications, code, algorithms, and models, and 4) trainings, students, and visiting scientists. Dr. Linnenbrink explained that the working group looked closer at these products and brainstormed what metrics could be used to measure the impact of these research products.

Ms. Linnenbrink explained that the process began by reviewing classic metrics used to track impact, including the number of published journal articles, journal impact factors, and the number of citations. Ms. Linnenbrink noted the group sought to explore alternative metrics to the number of CompTox datasets downloads, the number of people talking about CompTox research on social media and media platforms, and various other measures.

The search for alternative metrics resulted in the development of an online application, which is not yet finalized. Ms. Linnenbrink gave an overview of the website. The various metrics are organized into four categories to reflect the target of the measured impact: 1) scientists, 2) publications, 3) data and tools, and 4) overall impact, which reflects social media and media outlet traffic related to CompTox research. Ms. Linnenbrink noted that most of the progress to date has been made in the "scientist" and "publication" areas.

The "scientist" area of the site features a list of the Agency CompTox researchers. Links for individual researchers provide expanded details on their background, important publications, and specific measurements on the impact of their work. Ms. Linnenbrink explained that adjacent to each publication there are various accompanying metrics, including Altmetric, PlumX, and Kudos. The Altmetric icon indicates how many times the paper is blogged about, how many times it is mentioned on social media platforms such as Facebook, Twitter, or Google+, how many times it is mentioned on peer review sites, and the number of readers on CiteULike and Mendeley. Ms. Linnenbrink also noted that metric information is provided for each specific scientist under their picture, including linking icons to the scientist's PlumX, ID, LinkedIn and Research Gate profiles.

The "publications" area of the site provides a list of all National Center for Computational Toxicology (NCCT) publications with their accompanying metrics. Ms. Linnenbrink explained that the classic metrics, including the number of abstract views, citations, and downloads, are included under each citation. Next to the citation is a list of the associated research project(s). Ms. Linnenbrink noted that the same alternative metrics used to track impact in the "scientist" area of the website are also used in the "publications" area.

Ms. Linnenbrink presented a new area of development investigating the use of other tools, including Google Analytics, to showcase usage of CompTox data and online applications. Ms. Linnenbrink included an example in which Google Analytics was used to monitor the release of

the online CompTox Chemistry Dashboard application in April 2016. Tracking Google Analytics showed that visitation to this web application increased following the announcement of the application's release. Ms. Linnenbrink also discussed the application of Google Analytics to track the impact of the ToxCast program's high-throughput screening (HTS) data released in December 2015. Following the public announcement of the data release, Google Analytics facilitated the tracking of the total number of page views and new page views for the ToxCast download website, where the HTS data were accessible. Ms. Linnenbrink further noted that Google Analytics can be used to track the geographic source of the site viewer, as well the viewer's domain of origin (e.g., a ".com" or ".gov" site).

Ms. Linnenbrink also mentioned the "overall impact" portion of the online application, which is intended to showcase the overall media coverage that CompTox research has received. An example provided by Ms. Linnenbrink highlighted the measurement of the number of news clips to estimate the media coverage following the release of the HTS data.

Ms. Linnenbrink concluded the presentation by discussing the next steps related to this project. First, she touched on the need to continue investigating the relevance of these measures and to explore additional data to collect. Second, she recommended the continued investigation into novel ways combine scores into institution wide scores, which can then be used for comparisons across similar research institutions. Third, Ms. Linnenbrink discussed the importance of determining ways to track the use of CompTox data in decision making. Lastly, she described the need to integrate these concepts into EPA's existing information technology systems.

Metrics Discussion

Deborah Swackhamer, Chair

Dr. Swackhamer thanked Ms. Linnenbrink for her research efforts and clear presentation. Dr. Swackhamer asked for clarifying questions from the EC members.

Dr. Paula Olsiewski pointed out that some scientists are more comfortable using social media platforms to promote their work than others and asked Ms. Linnenbrink if this has been considered. Ms. Linnenbrink agreed that it is a challenging issue. She added that following the pilot program she has already noticed increased competition in social media usage to promote research products between departments. Ms. Linnenbrink explained that she hopes to spread awareness about how the tools can be used to highlight the impact of scientist's work and help facilitate trainings for scientists and post-doctoral fellows.

Dr. Earthea Nance commented that there is another system called BE Press released by UC Berkley which has an institutional repository software called "Digital Commons." Dr. Nance explained that she thought this was a helpful tool and that she was surprised it was not discussed in this presentation. Ms. Linnenbrink replied that she believes use of Digital Commons to access publications is tracked through PlumX.

Dr. Corley asked about the timeframe for the CompTox publication data collection, and whether it is focused on evaluating the whole program or one particular project. Ms. Linnenbrink answered that the CompTox program was started in 2005 and the data was collected from that point forward.

Dr. Kavlock commented that he does not think any particular method alone will be entirely accurate in measuring a program's impact and urged for the use of multiple methods in evaluation. Dr. Kavlock thanked Ms. Linnenbrink and the NCCT for this work and expressed his hope that this presentation has sparked interest among the EC members.

Dr. Swackhamer echoed Dr. Kavock's comment, noting the need to consider a diverse set of metrics. Ms. Linnenbrink agreed that it can be difficult to determine the appropriate methods of measurement for an outcome, as there are many measurement sources and metrics to consider. Ms. Linnenbrink reiterated that the ultimate goal is to ensure that the research ORD produces is used by decision makers to inform Agency policy, but determining how to measure that can be difficult. Ms. Linnenbrink also mentioned that there are other methods for measurement to track interest in data or research that were not discussed in this presentation, including surveys of stakeholder interest.

Dr. Swackhamer asked for any clarifying questions from the EC members, and there were none. She commented that she believes the CompTox pilot program is extremely valuable, and challenged the EC members to think about how these methods of evaluation can be implemented and applied to the research programs in ORD.

Environmental Justice Roadmap Presentation

Andrew Geller, Environmental Justice Roadmap Lead

Dr. Swackhamer introduced the next portion of the meeting dedicated to reviewing the revised Environmental Justice (EJ) Roadmap which was modified to address the EC's previous comments.

Dr. Andrew Geller began his presentation on the revised EJ Roadmap by underscoring Dr. Flint's previous comment on the importance of considering the context of communities and social environments in which people live when assessing environmental exposures and impacts. Dr. Geller stated that EPA's overarching goal is for "all communities and persons across the nation enjoy the same degree of protection from environmental and health hazards and equal access to the decision-making process to have a healthy environment in which to live, learn, work, and play." He explained that the particular goal of the EJ Roadmap is "that this protection is extended to overburdened communities – minority, low income, tribal populations or communities in the United States that potentially experience disproportionate environmental hazards and risks." Dr. Geller noted that EPA has been moving towards successful "just sustainability," which strives for a better quality of life for all – particularly overburdened communities – within the limits of our supporting ecosystem.

Dr. Geller explained that the goal of ORD research addressing EJ is to strengthen the scientific foundation for actions that address environmental and health inequalities in overburdened populations and communities. Dr. Geller stated that the EJ Roadmap is organized around four science challenges, or research activity areas: 1) decision support, citizen science, and community engagement, 2) environmental health disparities and cumulative assessment, 3) tribal sustainability and well-being, and 4) climate justice.

Dr. Geller reviewed how the EJ roadmap revisions responded to the EC's recommendations. First, Dr. Geller explained that the problem statements located in the introductory sections and body of report were revised to be more consistent, and efforts were made to cite more deeply the drivers for EJ research and the EPA EJ research program. Second, Dr. Geller explained that the new roadmaps includes many new references to bolster motivation for the research, the organization of the science challenges, and the identification of research gaps. Third, he explained that the updated roadmap links the science challenges to different aspects of EJ. Dr. Geller noted in particular a recommendation from an ORD social scientist to look deeper into the various theories of justice, which helped organize the EJ issue into several different theories of justice, including procedural justice, distributional justice and recognition justice. He noted that these theories linked well with the science challenges, though the issues involve many societal factors that are outside of the Agency's direct control. Despite this, Dr. Geller underscored that these factors should still be recognized when discussing EJ. Lastly, he acknowledged that a deeper survey of the background literature led to an expanded discussion of the science gaps. The initial draft worked from the list of gaps drafted by the National Environmental Justice Advisory Council, and the updated EJ Roadmap includes the following four additional science gaps: 1) environmental health disparities, cumulative assessment, and the built, natural, and social environments, 2) equitable distribution of ecosystem services, 3) standardized methods and metrics for EJ analyses, and 4) social science capacity.

Environmental Justice Roadmap Discussion

Deborah Swackhamer, Chair

Dr. Viney Aneja asked Dr. Geller to clarify the definition of "over-burdened populations." Dr. Geller explained that "over-burdened" is a term used in Executive Order 12898 on EJ to describe "minority, low income, tribal populations, or other communities in the United States that potentially experience disproportionate environmental hazards and risks." Dr. Geller explained that the term "disproportionate" is considered by the EPA as a policy judgement that is informed by analysis and is, in many cases, dependent on the availability of scientific data.

Dr. Flint praised the revised roadmap and lauded the inclusion of the science gaps and science challenges. She noted that the document contains a strong emphasis on race, income and indigenous issues, but highlighted that there are various other factors receiving attention recently including: age, urban vs. rural, gender, as well as the intersection of demographics and other spatial aspects of exposure. Dr. Flint asked whether there was room in this report to expand

beyond the emphasized factors of race and income to include some of these other dimensions. Dr. Flint also pointed to the need for additional clarity on the distinction between overburdened "communities" and "populations." She noted that the inclusion of both terms in the problem statement is good, but could perhaps be clarified later in the report. She added, however, that there may be an overuse of the term "community," which in some cases could be replaced with "population." Lastly, Dr. Flint commended the good information on metrics and indices, but suggested a more extended discussion on the comparison of different measurement techniques and tools for identifying overburdened populations.

Dr. Geller thanked Dr. Flint for comments. He noted that he is also interested in investigating the other factors related to EJ, and explained it is an area ORD scientists are already researching. Dr. Geller also stated that work to develop indices such as the environmental quality index that account for many factors, including rural versus urban, are already underway. He added that the roadmap uses the term "community" more often because of the place-based nature of EJ. Last, he would like to expand the discussion on metrics and looks forward to getting input from ORD scientists on this.

Dr. Kavlock commented that EPA recently released the EJ 2020 plan, noting that the EJ Roadmap was featured frequently in the science section of the document. He also mentioned that the EJ Roadmap was already being used in other official Agency documents as well.

Dr. Gina Solomon echoed previous comments that the revised EJ Roadmap is a strong document. She commented on the importance of citizen science and was happy to see it emphasized in the roadmap. Dr. Solomon added that all previous EC recommendations were addressed well, and she approved of the organization and framing of the document. Dr. Solomon further commended the EJ Roadmap's successful cross-programmatic and cross-disciplinary nature, and noted that it links well with the other roadmaps.

Dr. Swackhamer proposed that the EC approve the revised draft version of the EJ Roadmap. Dr. Kavlock and Dr. James Galloway agreed that the EJ Roadmap Draft should be approved. Dr. Flint affirmed that her comments are in the spirit of the Roadmap being a "living document" and also approved the EJ Roadmap. There were no objections. The EC approved the EJ Roadmap.

Dr. Geller thanked the EC members for their comments, and remarked that he will continue to make improvements to the document in the future.

Climate Change Roadmap Presentation

Andy Miller, Climate Change Roadmap Lead

Dr. Andy Miller began his presentation by describing how the Climate Change (CC) Roadmap was rewritten to address the EC's comments in a comprehensive way. Dr. Miller explained that most of the recommendations focused on clarifying the definition of ORD's CC work and its research priorities as well as highlighting the program's value.

Dr. Miller described that the CC Roadmap was re-organized around three science challenges to provide actionable research in response to EPA partner needs. Dr. Miller summarized the three science challenges: 1) to develop the knowledge base to support and enable partner offices to meet the Agency's mission in the face of non-stationarity in the climate system (adaptation), 2) to inform the development, implementation, and benefits assessment of greenhouse gas control regulations (mitigation), and 3) to identify and evaluate long-term, sustainable solutions for both the causes and consequences of CC (sustainability). Dr. Miller explained how all of these scientific challenges cut across ORD and EPA. He hopes the revised roadmap provides a better picture of the management of interactions across ORD, the Agency as a whole, and other Federal partners.

Dr. Miller explained that the three science challenges provide a good foundation for the work conducted at the Agency, but highlighted the need to put these challenges in the context of how to move EPA forward. Dr. Miller stressed that for each science challenge, the hope is to continue to build a more integrated approach, cutting across programs and considering CC in a more holistic way. Dr. Miller explained the revised roadmap includes three guiding principles to steer towards an integrated effort that: 1) is predicated on a systems science approach that prioritizes cross-media, cross-scale, and cross-disciplinary research, 2) explicitly considers the social dimensions of change, both as part of the fundamental nature of CC and as an essential element for moving the results of that science into action, and 3) focuses ultimately on solutions to the threat CC poses to EPA's mission and to society, moving from the current focus on risk identification and characterization to the science needed to support responses. Dr. Miller further noted his hope to build from these principles and scientific challenges as starting points as the program evolves in coming years.

Dr. Miller concluded his presentation by explaining that the CC Roadmap provides a foundation for the dynamic interactions between ORD and other EPA partners that inform Agency decision making. In particular, Dr. Miller addressed one of the key recommendations made by the EC: ensuring that ORD's work is actionable. Dr. Miller explained that activities such as the Partner Alliance and Coordination Teams (PACTs) serve as the venues for discussions of needs, results, and interpretation across the organization, and help ensure that the necessary research is conducted in a way it can be used properly. Climate-related PACT members represent the Air, Climate, and Energy (ACE) research program, partners, and other ORD programs, and noted that initial PACT meetings have been held to focus on specific topics. Dr. Miller praised the productive interactions at these PACT meetings thus far, and explained that these discussions will help meet the promise of identifying key research priorities and communicating results properly in order to inform decisions. Dr. Miller further noted that PACTs and other communication efforts have the potential to not only help the EPA internally, but also provide EPA perspectives in the communication of needs, issues and contributions to the United States Global Change Research Program (USGCRP) and other interagency bodies.

Dr. Miller remarked that he believes the revised CC Roadmap provides a more coherent guide for CC work in the future. Dr. Miller illustrated the value of the CC Roadmap's new organization by noting that the recommendations for future work resulting from a recent meeting on Climate and Health could be successfully categorized under the CC Roadmap's science challenges. Dr. Miller finished his presentation by expressing his opinion that the revised Roadmap serves as a good starting point, and looks forward to the comments and perspectives of the EC members on how to further improve this document.

Climate Change Roadmap Discussion

Deborah Swackhamer, Chair

Dr. Swackhamer thanked Dr. Miller for his hard work on the revision of the CC Roadmap and for his responsiveness to the recommendations from the EC.

Dr. Galloway expressed his gratitude towards Dr. Miller for his hard work on this report and noted his satisfaction with the new revisions. He stated that the CC Roadmap provides a great overview and is much improved from the previous edition.

Mr. Shahid Chaudhry commented that from a water quality standpoint, the revised CC Roadmap is a solid document that provides a detailed plan on the long term goals related to water quality from the CC perspective.

Dr. Robert Richardson underscored the previous comments that the document has been greatly improved. He particularly likes the organization around three science challenges. Dr. Richardson also praised the clear language regarding the integration of social sciences. In addition, he noted that one of the overarching comments from the previous review of the Roadmap was that there was too little attention placed on adaptation versus mitigation, and that there were too few specific details regarding ongoing research related to adaptation. Dr. Richardson stated that the new Roadmap addresses this issue and praised the extended discussion on adaptation in the revised document. He also found the sections on Human Health and Land and Ecosystems particularly strong.

Dr. Olsiewski agreed that the document is greatly improved.

Dr. Ponisseril Somasundaran asked whether there was an effort to distinguish between the man-made and natural effects on CC in order to focus resources on targeting man-made effects. Dr. Somasundaran explained that he understands resources are put towards addressing man-made effects but noted that natural effects like wildfires, earthquakes, and volcanoes also affect the climate. Dr. Miller replied that other federal agencies research the attribution of changes in the environment (e.g., sea level rise, temperature, etc.). Dr. Miller added that from EPA's perspective, in the context of adaptation, determining why the climate is changing is not important. As an Agency, EPA must respond to ensure human health and safety are protected regardless of the cause of climate change. Dr. Miller notes that, therefore, the attribution

component is important to understand the benefits of mitigation and to identify the sources that need to be migrated. However, from the perspective of adaptation, it is not important.

Ms. Smith agreed with the previous comments on the improvements to the document and added that she particularly likes the organization around the three science challenges. Ms. Smith commented that the three science challenges were stated more succinctly in the accompanying presentation slides than in the CC Roadmap document itself, and noted that the parenthetical words of "adaptation," "mitigation" and "sustainability" included in the slide were particularly helpful in understanding the three science challenges. Dr. Swackhamer agreed that the inclusion of these words was helpful and remarked that this should be an easy comment to address.

Dr. Flint echoed that the CC Roadmap has been vastly improved and applauded Dr. Miller's efforts. Dr. Flint remarked that the Agency's roles and relevance related to actions to address CC are much clearer. Dr. Flint also noted that she appreciated the three S's in the guiding principles: systems, social, and solutions. Dr. Flint raised two issues to consider in the on-going development of the CC Roadmap. First, she noted that opportunities for systems thinking and social science connections, beyond cost-benefit analysis, could be useful. Second, Dr. Flint also noted the importance of continuing to investigate connections with the social sciences and commented that she believes the specificity of these social science connections will emerge over time as ORD engages more deeply with these issues.

Dr. John Tharakan also agreed that the CC Roadmap has been greatly improved since the last review. Dr. Tharakan would like to see more explicitness and clarity related to how EPA integrates and collaborates with other government agencies, as there is much overlap with regards to the research questions the Agency addresses.

Dr. Swackhamer noted the general consensus that the EC is pleased with the revised version of the CC Roadmap. Dr. Swackhamer proposed that the EC approve the revised draft version of the CC Roadmap. There were no objections.

Dr. Miller thanked the EC members for their comments on the revised CC Roadmap and extended a special thanks to Dr. Chris Weaver for his integral role in writing the revisions.

Children's Health Roadmap Annual Report

John Cowden

Dr. Kavlock explained that the goal of producing the annual reports is to demonstrate the progress of the research programs along their individual roadmaps through the end of September 2016. He reiterated that the program roadmaps are at different stages of development, which is reflected in the annual reports. For instance, the Nitrogen Annual Report is more fully developed compared to the CC Annual Report due to the recent revisions to the CC Roadmap.

Dr. Cowden began the presentation on the Children's Environmental Health (CEH) Roadmap Annual Report by reiterating that the roadmaps aim to be crosscutting across EPA's National Research Programs. He noted that the CEH Roadmap is around 18 months old. Dr. Cowden

presented a highlight of the progress made in 2016, which included: 1) a significant output of over 60 ORD publications on CEH in fiscal year (FY) 2016; 2) direct impacts on Agency decisions related to pesticides and endocrine disruptors; 3) research that supported key public health issues: safe drinking water, indoor air, Zika virus; 4) funded five new Children's Health Research centers studying asthma, autism, leukemia, microbiome, nonchemical stressors; and 5) outreach to program and regional partners through the CEH Implementation Working Group. He noted that one of the products from the CEH Implementation Working Group was this annual report.

Dr. Cowden presented relevant information from the CEH Roadmap to address Charge Question 1, which addresses integration and implementation. He summarized some of the CEH impacts, including work related to a Zika virus adverse outcome pathway, certification of pesticide applicators, Endocrine Disruptor Screening Program (EDSP) pivot, and perchlorate dose-response modeling. Next, Dr. Cowden explained some areas of innovation, or new awards which helped drive cutting edge research. These included the Pathfinder Innovation Projects, Small Business Innovation Research (SBIR), and Science to Achieve Results (STAR) Grants. Dr. Cowden also discussed integration, which is occurring at all levels—within ORD, with intramural and extramural partners, and with national programs. Lastly, Dr. Cowden expressed the progress related to outreach, which includes various Scientific Advisory Boards and public outreach initiatives, including work with Pediatric Environmental Health Specialty Units (PEHSUs) and the development of the CEH research website to provide public with information on ongoing activities.

Dr. Cowden next presented relevant information from the CEH Roadmap to address Charge Question 2, which focused on opportunities and focal points for FY2017. Dr. Cowden expressed his excitement about the Chemical Safety in 21st Century Act ("new TSCA"), as childhood is identified as a key life stage to be examined. In addition, Dr. Cowden noted that in developing the annual report, the group realized the need for continued integration of CEH research within and across the National Research Programs and with other research roadmaps including the EJ and CC Roadmaps. Dr. Cowden also discussed the need for a future focus on science translation and dissemination of research products. Dr. Cowden continued the presentation by highlighting some near term efforts, including increased focus on reproductive and developmental health, low dose exposures, the Children's Environmental Health and Disease Prevention Centers meetings with the National Institute of Environmental Health Science, and the Organotypic Models meeting at the Society of Toxicology conference.

Nitrogen and Co-Pollutant Roadmap Annual Report

Anne Rea

Dr. Anne Rea introduced the cross-Agency work related to nitrogen and its co-pollutants and highlighted some of the program's recent accomplishments, which include: conducting a workshop related to air quality and ecosystem services and a multi-agency (USGS/USDA/EPA)

workshop focused on agricultural sources of nutrient pollution, coordinating a January 2017 Office of Science and Technology Policy meeting ("Visions for Optimizing Nutrient Monitoring: Deposition and Water Quality"), winning open innovation prizes related to challenges and data visualization, publishing nearly 100 peer reviewed journal articles, writing four book chapters and 12 reports, and hiring two cross-ORD Oak Ridge Institute for Science and Education (ORISE) Fellows.

Dr. Rea gave an overview of one of the research program's flagship project: Multimedia Nitrogen Modeling for the Mississippi River Basin and Northern Gulf of Mexico. The effort develops watershed multimedia scenarios of air quality and deposition, watershed processing, water quantity and quality to address nutrient management and alternative climate and land use futures. She remarked that the multimedia approach is unique and, by considering environmental, social and economic impacts of the nitrogen cascade, it produces a fuller picture of sustainable solutions.

Next, Dr. Rea pointed to several cross-program efforts related to the Secondary National Ambient Air Quality Standards (NAAQS) for nitrogen oxides and sulfur oxides, including work that connects nitrogen deposition and aquatic ecosystem responses using the Office of Water (OW) national aquatic resource surveys and work that integrates and evaluates scientific data on deposition and ecological effects associated with ambient air concentrations of total reactive oxidized nitrogen, ammonium, and sulfur oxides.

She also informed the EC members that ORD held a cross-Agency workshop on reactive nitrogen and co-pollutants to build synergy across programs that garnered enough interest to support quarterly meetings on Linkages between nutrients and harmful algal blooms, interactions between nutrients and climate, integrated approaches that allow decision-makers to make trade-offs (regulatory, voluntary, incentives, markets, etc.), dose-response functions for ecological endpoints and ecosystem services, and measurement model fusion: using an integrated approach for data fusion.

Finally, Dr. Rea reviewed several Science Advisory Board roadmap recommendations, and suggested that the program is on track to address them. In closing, she addressed the last recommendation ("EPA should convene an inter-Agency reactive nitrogen management task force to coordinate federal programs that address reactive nitrogen monitoring, modeling, research, and management") by describing an image showing the different areas the relevant agencies operate within and how they align with one another.

Dr. Flint asked for clarification on the connections with social science, specifically as it relates to the role of the urban environment. Dr. Rea replied that most of the research related to this roadmap is more focused on ecosystems as opposed to human health, though social aspects are considered in monetary and non-monetary valuation of ecosystem services. Dr. Flint commented that it would be interesting to consider the residential and agricultural nutrient management practices and institutional uses of nutrients in future work.

Dr. Aneja noted that the work Dr. Rea discussed was water quality-focused, and asked whether the roadmap considers air quality as well. Dr. Rea reminded the EC members that the work related to the Secondary NAAQS is air quality-related, though it was not specifically called out as a case study. Dr. Aneja commented that the document might be strengthened by including an air-specific case study. He then pointed out that the Nitrogen and Co-pollutant Roadmap Annual Report did not discuss ammonia reductions, and asked how the program will tackle that issue. Dr. Rea responded that the program is conducting the research, and the Integrated Science Assessment reports on air deposition and ecological effects of all forms of reactive nitrogen. She clarified that the Agency does not have the authority to regulate reduced forms of nitrogen in air, so Agency efforts will need to focus on voluntary programs in this area.

Environmental Justice Roadmap Annual Report

Andrew Gellar

Dr. Geller began the presentation by discussing highlights from the EJ Roadmap Annual Report. First, Dr. Geller discussed the agency collaborations using scientific and technical expertise while addressing place-based EJ issues, highlighting approximately 45 projects from the Making a Visible Difference, Regional Applied Research Effort (RARE), and Regional Sustainable Environmental Science (RESES) programs. He explained these projects are not only important because they illustrate the Agency's response to real problems, but they are also important for the EJ 2020 plan.

Next, Dr. Geller discussed the accomplishments of the granting program, citing 48 grants from ORD's STAR program from the ACE, Sustainable and Healthy Communities (SHC), and Safe and Sustainable Water Resources (SSWR) research programs. In the last year, ORD funded five new CEH centers focused on environmental exposures and the social determinants of health, five new Centers of Excellence on environmental health disparities research, and six grants on air pollution monitoring for communities that will be important for including citizen science in broad Agency community efforts. In the coming months, ORD will fund two new grants. The first will consider integrating human health and well-being with ecosystem services and the second will consider using a total environmental framework to assess lifelong health effects of chemical exposures, which will address issues related to EJ.

Lastly, Dr. Geller discussed responsive intramural research. For example, in response to the Flint, Michigan, incident and to address household levels for lead in drinking water, investigators modeled lead contamination in drinking water to inform updates to the Lead and Copper Rule. He also noted the ongoing research related to Zika Virus, including a collaboration with Region 2 and Region 6 on mosquito breeding habitats and disease vector mitigation.

Dr. Geller also discussed various other accomplishments, including a set of papers on near-source air quality monitoring, research on epigenetics as a potential mode of action for cumulative impacts, and research considering disparities in access and the impact on ecosystem services. In the near future, ORD will publicly release the Community-Focused Exposure and

Risk Screening Tool (C-FERST), the Community modeling system for near-PORT (C-PORT) air quality modeling tool, research on the wildfire vulnerability index, and the development of a climate resilience screening index.

Mr. Chaudhry asked if there is a regulation that involves both copper and lead together. Dr. Geller explained that he was referring to an OW rule that regulates the levels of lead and/or copper in drinking water, and that he does not believe the two are necessarily linked. Mr. Chaudhry mentioned a recent paper that assesses the relationship between the percentages of iron and lead. Dr. Geller thanked Mr. Chaudhry for his suggestion and he will look into this further.

Climate Change Roadmap Annual Report

Andy Miller

Dr. Miller presented an overview of the CC Roadmap Annual report, focusing in particular on the cross-program efforts and accomplishments. Dr. Miller began by highlighting the research output of the program, which included 360 papers, presentations, and other products submitted for review from across the ORD programs. Dr. Miller also emphasized the progress on methane reservoir research to support Office of Air and Radiation (OAR) and Administrator priorities, which has advanced the understanding of emission contributions from methane reservoirs. Significantly, the Intergovernmental Panel on Climate Change is now considering methane reservoirs in their discussions related to international emissions inventories. Dr. Miller highlighted the significant impact of the USGCRP National Climate and Health Assessment, which contained major ORD contributions in the air quality chapter. He also discussed the $10M in STAR grants, which represents the evolution of air quality-focused research centers considering the effects of air quality on CC and vice versa. Lastly, Dr. Miller reiterated that he is pleased with the revised CC Roadmap, and thinks the new CC Roadmap provides a solid foundation for future research.

Dr. Miller reviewed some ongoing activities across research programs. First, he discussed the dynamic downscaling of climate data developed for ACE air quality models incorporated into SSWR water quality studies; the research has utilized global modeling reports down to the regional scale. Second, he mentioned that the coastal acidification research in ACE and SSWR is being integrated to expand capabilities. Overall, the activities illustrate connections across ORD, as well as across different agencies.

Dr. Miller next discussed the plans for upcoming year. First, he expressed his excitement to continue to build collaborative efforts across the Agency and other programs related to climate and health. He also commented that other agencies could become involved in the climate-health research area to adequately address the range of climate-related health effects. He also added that this research area, in particular, could benefit from the incorporation of social science research. Second, Dr. Miller anticipated ORD will play a significant role in developing the fourth USGCRP National Climate and Health Assessment. Third, Dr. Miller noted the climate-water assessment, which reflects a partnership with OW to connect science with the policy decision-

making process. Finally, Dr. Miller commented on the recently developed PACTs, which aim to expand connections between ORD and Agency partners, noting that he looks forward to continue using these PACTs to facilitate communications that assist Agency partners make informed decisions.

Mr. Chaudhry commended Dr. Miller for the good work and his overview, particularly noting the success in nearly doubling the number of publications. He asked about the reason for such an increase. Dr. Miller responded that he believes it is due to a combination of the natural development process of the CC Roadmap and the Agency's increased focus on CC.

Mr. Chaudhry further commented on the wide range of areas and the cross-cutting nature of the research, highlighting the impact of the CC Roadmap. He noted, though, that it does not appear to address mitigation. Dr. Miller responded that the highlighted accomplishments he touched on are focused on cross-program activities, and that most of the mitigation-focused work occurs solely within the ACE program.

Roadmap Annual Report Charge Questions Discussion

Deborah Swackhamer, Chair

Dr. Swackhamer redirected the focus of the discussion to the Roadmap Annual Report Charge Questions. She clarified that Charge Question 1 considers current progress and the second Charge Question assesses future work. She asked Dr. Kavlock if the first sub-bullet under Charge Question 1 ("Levels of commitment to Roadmap recommendations as incorporated into the ORD StRAPs") is intended to evaluate the level of commitment of the Roadmap staff or from the roadmaps back to the Strategic Research Action Plans (StRAPs). Dr. Kavlock replied that it reflects the longer-term goals of the relationship between the roadmaps and the StRAPs, which may be difficult to assess this early.

Dr. Olsiewski asked whether it would make sense to ask about the progress toward successful integration and implementation rather than areas of successful integration and implementation and levels of commitment.

Dr. Kavlock clarified that this would mean changing the wording in Charge Question 1 and deleting the first sub-bullet to read:

"*Comment on the progress toward successful integration and implementation as articulated in the related Roadmap. This may include, but is not limited to, the following:*

- *Coordination across ORD's six National Research Programs;*
- *Communication and outreach to partners and stakeholders; and*
- *Areas of innovation*"

The EC members agreed with these changes.

Dr. Swackhamer suggested that Charge Question 2 is acceptable, and the EC members agreed.

Next Steps

Deborah Swackhamer, Chair

Dr. Swackhamer stated that the EC members will form four groups to write the reviews of the annual reports. The reviews themselves will be short and less onerous than the StRAP reviews. Furthermore, because the members will be working in small workgroups, they will not be subject to the FACA rules, though Mr. Tracy can help coordinate calls if that is preferable.

The annual report draft reviews and the subcommittee draft reports on the national research p programs are due to Dr. Swackhamer on December 23, 2016. Dr. Swackhamer encouraged all members to send their written comments or summaries of their verbal comments to the appropriate workgroup or subcommittee leads.

Adjourn

Thomas Tracy, Designated Federal Officer

Mr. Tracy thanked the presenters and EC members for their participation, and adjourned the meeting.

Appendix A: Agenda

United States Environmental Protection Agency
Board of Scientific Counselors (BOSC)
Executive Committee (EC)
Meeting Agenda – November 1, 2016

1:00 p.m.	Convene Meeting	Thomas Tracy Designated Federal Officer
1:05 p.m.	Welcome	Robert Kavlock Deputy Assistant Administrator for Science
1:10 p.m.	Introduction of Members	Deborah Swackhamer, Chair
1:15 p.m.	Review Agenda Meeting Charge and Process	Deborah Swackhamer, Chair
1:25 p.m.	Public Comments	Registered Speakers
1:35 p.m.	Update on Social Science	Robert Richardson Courtney Flint
1:50 p.m.	Introduce the Topic of Program Evaluation and Metrics	Susan E. Cozzens Elizabeth Corley
2:05 p.m.	CSS Program Metrics	Monica Linnenbrink, ORD
2:15 p.m.	Metrics Discussion	Deborah Swackhamer, Chair
2:45 p.m.	Presentation Environmental Justice Roadmap	Andrew Geller, Roadmap Lead
2:55 p.m.	Discuss Environmental Justice Roadmap	Deborah Swackhamer, Chair
3:05 p.m.	Presentation Climate Change Roadmap	Andy Miller, Roadmap Lead

3:15 p.m.	Discuss Climate Change Roadmap	Deborah Swackhamer, Chair
3:35 p.m.	BREAK	
3:55 p.m.	Presentations Annual Reports	John Cowden, Children's Health Roadmap Anne Rea, Nitrogen & Co-Pollutant Roadmap Andrew Geller, Environmental Justice Roadmap Andy Miller, Climate Change Roadmap
4:20 p.m.	Discuss Charge Questions Annual Reports	Deborah Swackhamer, Chair
5:10 p.m.	Next Steps Closing Comments	Deborah Swackhamer, Chair
5:30 p.m.	Adjourn	Thomas Tracy Designated Federal Officer

Appendix B: List of Participants

BOSC Executive Committee Members:

Deborah L. Swackhamer, *Chair*
Viney Aneja
Shahid Chaudhry
Susan Cozzens
Courtney Flint
James Galloway
Earthea Nance
Paula Olsiewski
Diane Pataki
Kenneth Reckhow
Robert Richardson
Sandra Smith
Gina Solomon
Ponisseril Somasundaran
Tammy Taylor
John Tharakan

EPA Designated Federal Officer (DFO):

Tom Tracy, *Office of Research and Development*

EPA Presenters:

Andrew Geller, *Office of Research and Development, Deputy National Program Director for the SHC Research Program*
Andy Miller, *Office of Research and Development, Associate National Program Director for the ACE Research Program*

Other EPA Attendees:

Robert Kavlock
Maureen Gwinn
Tina Bahadori
Viktoriya Plotkin

Other Participants:

Maria Hegstad
Bo Jackson
Benjamin Kallen
Rachel Leven
Nicholas Lovesee
Jennifer Lowry
Pat McCollough
Julia Stockton

Contractor Support (ICF):

Ali Goldstone
Devon Morgan

Appendix C: Roadmap Annual Report Charge Questions

BOSC REVIEW OF ROADMAP ANNUAL REPORTS

Background

Within the past year, EPA's Office of Research and Development (ORD) released its cross cutting Research Roadmaps (https://www.epa.gov/research/research-roadmaps) to describe current and facilitate future integrated ORD research across four prominent cross-cutting areas: Nitrogen and Co-Pollutants, Children's Environmental Health, Environmental Justice, and Climate Change. The cross-cutting Research Roadmaps are not stand-alone research programs; rather, they integrate research in these priority areas across ORD's six Strategic Research Action Plans (https://www.epa.gov/research/strategic-research-action-plans-2016-2019) developed by the six ORD National Research Programs: Air, Climate, and Energy (ACE); Chemical Safety for Sustainability (CSS); Human Health Risk Assessment (HHRA); Safe and Sustainable Water Resources (SSWR); Sustainable and Healthy Communities (SHC), and Homeland Security (HS). This integrative vision focuses ORD's investment on areas where EPA can play a significant leadership role and ensures that cross-cutting research is the foundation of sustainable decisions and actions in these four priority areas.

This first issue of the Annual Reports for each of the Research Roadmaps captures progress on research goals and activities during Fiscal Year 2016 (FY16; October 1, 2015 to September 30, 2016) in each of these four areas. The Annual Reports highlight successes and challenges of implementing an integrative approach to ORD's cross-cutting research. The Annual Reports also provide a preview of research activities in the upcoming fiscal year.

Charge Question:

In reviewing the cross-cutting Research Roadmap Annual Reports, please:

- 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
- 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?