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

Air, Climate, and Energy Subcommittee

Face-to-Face Meeting Minutes

October 25–26, 2016

Date and Time: October 25, 2016, 8:30 a.m. to 5:00 p.m.; October 26, 2016, 8:30 a.m. to 12:15 p.m. Eastern Time

Location: EPA Research Triangle Park Main Campus Facility, 109 T.W. Alexander Drive, Research Triangle Park, North Carolina

Meeting Minutes

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

Tuesday, October 25, 2016

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

Welcome, Introduction, and Opening Remarks

Viney Aneja, Chair

Dr. Tim Benner, Designated Financial Officer (DFO) for the Board of Scientific Counselors (BOSC) Air, Climate, and Energy (ACE) Subcommittee, formally opened the meeting. Dr. Viney Aneja, chair of the BOSC ACE Subcommittee, welcomed the subcommittee members to Research Triangle Park on behalf of himself and Ms. Sandra Smith. Dr. Aneja requested that each member of the subcommittee introduce themselves. The following subcommittee members introduced themselves upon Dr. Aneja's request: Dr. Myron Mitchell, Dr. Louie Rivers III, Dr. Jinhua Zhao, Dr. Elena Craft, Ms. Sandra Smith, Dr. Charlette Geffen, Dr. Constance Senior, Dr. Jeffrey Arnold, Dr. Patrick Kinney, Dr. Art Werner, and Dr. Donna M. Kenski. Dr. Aneja welcomed all other staff, and anyone on the telephone.

After the introductions, his opening remarks included setting the stage for the next day and a half. He mentioned that when the committee last met in June 2015 there was a recommendation that ACE integrate a social sciences perspective into its portfolio and that has happened in the last year and a half. Dr. Aneja went on to summarize the three charge questions of the meeting, and the goals of the meeting. Lastly, he went over some housekeeping items and introduced Dr. Benner.

DFO Welcome

Tim Benner, Designated Federal Officer

Dr. Tim Benner, the DFO for the BOSC ACE Subcommittee, opened the meeting. He covered rules for the meeting, including the open public meeting. He explained that the BOSC is a federal advisory committee, and he is responsible for ensuring that all BOSC activities comply with the Federal Advisory Committee Act (FACA). All meetings are open to the public per requirements of FACA and include an opportunity for public comment. Minutes are being taken by the Environmental Protection Agency's (EPA's) contractor and would be made public on the BOSC website after being certified by the chair. An electronic public comment docket had been established in the *Federal Register*, and no comments had been submitted to that docket.

He reminded the attendees that all meetings involving substantive issues—whether in person, by phone, or by email—are open to the public. This applied to all group communications that include at least half of the subcommittee. As the liaison between the subcommittee and EPA, Dr. Benner (or any DFO) is required to attend all meetings. Announcements of the meetings would be placed in the *Federal Register* at least fifteen days prior to any meeting. In addition to the meetings being open to the public, Dr. Benner noted that all federal advisory committee documents are also available to the public.

Dr. Benner explained that he worked with EPA officials to ensure that all appropriate ethics regulations were satisfied. Subcommittee members and attendees needed to inform him of any conflicts of interest in any of the topics under discussion during any subcommittee deliberations. He mentioned that no member of the public had requested time to comment, but if anyone on the phone line would like to comment, there would be an opportunity to do so at 9:30 a.m. on

Wednesday, October 26, 2016. Public comments would be limited to three minutes each, and the phone line was for listening only.

Program Update and Discussion
Dan Costa, National Program Director

Dr. Aneja introduced Dr. Dan Costa, the National Program Director (NPD) for the ACE Research Program. Dr. Costa introduced the program updates section, and thanked everyone for coming, specifically Dr. Rivers from North Carolina State. He presented the question of whether BOSC could be modified to include more social scientists, and expressed openness to any comments or criticisms on how to move forward. He stated his intention to bring the audience up to speed on the ACE program, and what has happened over the past year. He mentioned that ACE is not a social science program, so efforts to include social scientists represents a new step, and that Dr. Bryan Hubbell from the Office of Air Quality Planning and Standards (OAQPS) would expand more on the relevance of social sciences to the subcommittee later in the meeting.

Before embarking on the next phase of his presentation, Dr. Costa mentioned that at 12:30 p.m. the Deputy of Science, Dr. Bob Kavlock, will virtually join the meeting. Dr. Costa mentioned Dr. Kavlock's background and how he would bring a strong perspective on the importance of incorporating social sciences. At this time, Dr. Costa proceeded to give an overview of what defines ACE and of its recent activities.

Dr. Costa started with a brief overview of the ACE program to provide context for what was to come. He introduced the six national programs under the Office of Research and Development (ORD), one of which is ACE, with the others being Sustainable and Healthy Communities (SHC), Human Health Risk and Assessment (HHRA), Chemical Safety for Sustainability (CSS), Safe and Sustainable Water Resources (SSWR), and Homeland Security (HS). He further explained that two of these programs, HS and HHRA, also have centers, and the other four are applied research endeavors across different labs and centers in ORD. He then outlined the four partner-stakeholder priorities resulting from an elaborate series of discussions with both internal and external stakeholders: Implementation Sciences, Emissions Science, Public Health/Welfare and Climate Change Preparedness. Dr. Costa mentioned that all programs had developed strategic research plans and copies were distributed to meeting attendees. They have developed four crosscutting research roadmaps, which are climate, environmental justice (EJ), nitrogen and co-pollutants, and children's health program. The strategies define the direction and the strategic flow of the program through 2019. The ACE vision is based on a problem statement, "Protecting health and the environment from the impacts of climate change and air pollution in a sustainable manner are central 21st century challenges." The vision that they have established is to provide cutting edge scientific information and tools to support EPA's strategic goals of protecting and improving air quality and addressing climate change.

Dr. Costa discussed the medley of FY2016 research topics and how their diversity reflects ACE program values. ACE views issues as being deeply interconnected and intersectional, and promotes a systems approach to executing research and policy.

- *Emissions and Measurements (EM)* develops technologies to characterize source emissions and ambient air monitoring for the ozone. Such as the deployment of seven additional Village Green monitoring stations as well as reports, publications and presentations related to the Air Sensors Toolbox.

- *Protecting Environmental Public Health and Well-being (PEP)* by developing activities to communicate the science and research findings to the public and healthcare professionals. A journal article was published using satellite based exposure metrics to assess cardiac biomarkers across populations with well-defined clinical and EJ risk factors.
- *Sustainable Energy and Mitigation (SEM)* involve assessing the environmental impacts and factors affecting energy sectors choices from extraction to end-use. A prototype energy scenario model was developed to assess benefits of greenhouse gas (GHG) reduction of air quality in a climate context.
- *Climate Impacts Vulnerability and Adaptation (CIVA)* assess the impacts of climate change on the environment and public health to inform the development of sustainable approaches to prepare for climate change.
- *Atmospheric and Integrated Modeling Systems (AIMS)* involves developing a modeling framework to examine the role of inter-continental transport on U.S. air quality and to study air quality-climate interactions.

Dr. Costa explained that each of these research topics has an embedded long-term goal, and they seek to execute short-term goals as well.

Dr. Costa explained that the next BOSC meeting will focus on the overall climate agenda, and that since EPA does not have much money to devote to climate research, they try to work with other federal laboratories and the United States Global Change Research Program (USGCRP), which can amplify the scope and impact of their research. Dr. Costa noted that progress was made this year in the area of emissions measurement, which may not have the "colorful lights" of other research topics, but is fundamental to implementation.

Dr. Costa said that the oil and gas work and developing emissions factors are the most important duties of ACE. He listed some of their upcoming research areas, such as developing sensor technology, where they are working with community members and entrepreneurs so that they stay up to date with what the public is doing. Dr. Costa noted that sensors are constantly questioned on accuracy, and this scares state and local workers. The Village Green, a successful project built by an implementer, measures PM, ozone, and will incorporate other meteorological factors. The Agency is constantly being asked to install more.

Dr. Costa noted other highlights, including SPECIATE version 4.5, an inventory that they need to update every year. He noted that they continue with important work on Federal Reference Methods (FRM) and Federal Equivalent Methods (FEM), most recently on ozone, and lead will be coming soon. They have a longstanding investment in this FEM and FRM. European companies are currently developing sensors that ACE is evaluating, so they could be sold in the United States. Dr. Costa noted that they finalized the Petroleum Refinery Rule, which are new requirements for passive monitoring systems that minimizes the risk of leaks. This went through because stakeholders wanted it. They are testing how it can be linked with dynamic sensing environments. Dr. Arnold then asked if this is for volatile organic compounds, which Dr. Costa confirmed. Dr. Costa noted that they are expanding the Village Green Project, which installs sensors that track air monitoring indicators by the minute. The most recent installation was in Houston, but many regions are trying to get them set up. The plans are made available if people want them, but the Agency does not have the money to install it everywhere. Dr. Costa noted that ACE is also working on next generation air monitoring, including through community

workshops, trainings, and an online toolbox. ACE seeks to give fundamental information for users to get started on how to evaluate sensors.

Dr. Costa noted a few research highlights, including atmospheric and integrated modeling systems, which are another fundamental functionality of ACE. Additionally, they performed an evaluation of the Congestion Mitigation and Air Quality (CMAQ) v5.1, which is used by regulators and others. Ultimately, the goal is to harness future sensor technologies and spread them widely such that, in combination with geographic information system (GIS) data, they could link all of the air monitoring data.

Dr. Costa commented on PEP, a transformative part of the ACE program under which ACE seeks to work with health professionals to educate the public. This program has been entirely revamped. When he started, ACE focused on evaluating standards. Recently, they have shifted towards communication and public education.

ACE invested heavily in an atherosclerosis study in five communities around the country. Dr. Costa mentioned that Dr. Wayne Cascio will elaborate on this topic later. Dr. Costa noted that everyone has a degree of atherosclerosis as they age, and that it is an exposure based impact that they are investigating further. Dr. Costa mentioned other work out of Dr. Cascio's division, CATHGEN, which studies individuals who have received cardiac catheters.

Sustainable energy and mitigation is an evolving part of the ACE program. Cookstoves have been a strong focus, with $9 million dollars invested, both nationally and internationally. Dr. Costa mentioned that ACE worked with the Global Alliance for Clean Cookstoves (GACC). To clarify, ACE is not developing cookstoves, but testing them and training people worldwide on testing methods that can be standardized, with the goal of reducing an estimated four million annual deaths from cookstove air pollution. ACE is also working to develop economic models for investigating air pollution impacts on human health and the environment, and testing if those models can be predictive at the community level.

Dr. Costa turned the discussion to where ACE is headed. ACE is challenged with working on the diverse air-climate-energy needs of program, regional, and states, which often differ in kind and in temporal needs. For the sensor work, ACE can apply anticipatory evolution to figure out where things are going, instead of just reacting as things occur. One future area of ACE research is air monitoring, specifically how it can be monitored and reported in a more meaningful way. Dr. Costa mentioned a recent Request for Application (RFA) for grant awards to six universities in collaboration with communities to apply sensors and determine possible uses, as well as a number of other workshops in that area. Dr. Costa argued that progress in interpretation and messaging is critical, since technological capabilities will soon be sufficient. He explained that it is currently difficult to interpret and internalize the significance of ozone levels, since abstract concepts like statistical likelihoods do not resonate with many people. Dr. Costa mentioned certain apps that have attempted to combat this issue using World Health Organization (WHO) standards.

Dr. Costa went on to detail upcoming work in the area of climate and energy. He discussed the development of models with partners and federal agencies to improve ACE's ability to leverage funding resources.

Dr. Costa detailed the issue of wildfires as an example of an environmental issue in which social sciences could help communicate its risks. He mentioned that wildfires have been increasing

problem over the past decade, and cited National Oceanic and Atmospheric Administration (NOAA) estimations that forty percent of particulate matter 2.5 ($PM_{2.5}$) was from wildfires in a recent year. While not anthropogenic in nature, Dr. Costa emphasized that these still pose significant public health concerns, which could be better communicated with the help of social sciences. To achieve this, they are working with EPA to develop a cross-federal platform to improve communication methods for these issues.

Dr. Costa then moved to discuss upcoming work in the area of public and environmental health. Last year, ACE decided they need standards and data in order to talk about public health. They have been looking at this issue for the past 10 months and hope to get guidance on how to proceed. Dr. Costa acknowledged that ACE needs to consider social sciences, not just moving forward, but also looking back to incorporate it earlier in the process. Dr. Costa clarified that ACE does not want a social science division, but rather that it ought to be incorporated in all of their work, and ACE is in the process of determining what that will look like. For things like the wildfire work, it is always important to consider how it is going to be communicated. ACE has been meeting with Dr. Dan Ariely at Duke University to discuss this communication, and Dr. Hubbell has been working with experts in the field. One of the things they did was to develop a conceptual plan. ACE needed to move beyond economic impacts and consider the amorphous area of quantifying well-being. Dr. Costa explained that ACE is currently operating on a case study basis, and that wildfires are the first of many topics. Sensors, followed by climate, are likely the next areas to focus.

Dr. Hubbell led work on developing a conceptual model for collaboration between social and natural sciences, which will be reviewed later in the meeting.

As another example of information issues, Dr. Costa mentioned that, relating to cardiopulmonary disease, many practitioners do not appreciate that reduced emission exposure can reduce disease, but instead only focus on smoking. Dr. Wayne Cascio mentioned that he gave a talk over 250 health care professionals, and that while all of them knew what the Clean Air Act (CAA) was, not a single one was familiar with $PM_{2.5}$, signifying that there was much work to be done in this area.

Dr. Costa noted that in May ACE hosted a wildfire summit. People in the Southeast have a lot of prescribed fires, so they have less issues with wildfires than in the West. While some experts think this makes a difference, there are considerations related to the ozone from the burns. While many different offices were invited to this summit, the Office of Water (OW) originally stated that they were not interested in fires. ACE presented the issues regarding the intersection of water and wildfires, including the erosion, pollution, and the effect of fire retardant chemicals. When OW conducted a study, they realized it was an issue that needed consideration. From the climate perspective, Dr. Costa mentioned that Dr. Kirk Baker, from OAQPS, is developing an atmospheric model to look at fire impacts.

ACE is currently developing Partner Alliance and Coordination Teams (PACTs), working with partner organizations from the regions and from the program offices. They have six PACTS, five are associated with key topic areas, and one on the issue of nitrogen and water. These teams have weekly meetings.

They have developed a portal, an ACE@work intranet page with faces and names to allow for better communication. Dr. Costa noted that information on the PACTS program, CIVA, and on their other work is posted on the site. The site is internal, and includes meetings, presentations,

and individual slides. He showed off the ACE@work Intranet site as one-stop shopping for everything that is done in the ACE program, and mentioned that it has been well-received. Lastly, Dr. Costa introduced Faces of ACE, a yearbook-style portal where everyone can get recognized and show what they are contributing.

Discussion

Subcommittee

Dr. Aneja opened the floor to the subcommittee to discuss Dr. Costa comments before moving to the charge questions.

Dr. Zhao asked how expensive the Village Green monitoring stations are. Dr. Costa answered that the plans are free, and that the contracted cost is roughly $75,000. Dr. Aneja asked what data the stations track other than $PM_{2.5}$ and ozone. Dr. Costa noted that meteorological data is also tracked, and that there are plans to add black carbon tracking.

Dr. Mitchell asked who is responsible for the quality assurance on the systems. Dr. Costa answered that maintenance is done by ACE. They do not have a full support system yet, but they are working to train the necessary workers. ACE plans to carry support through the first year, but after that it becomes too expensive to maintain.

Dr. Craft asked whether there was a formalized plan or communication effort with state agencies. Dr. Costa answered that there was no formalized plan, and that past communications have been through various professional connections. He noted that the state monitoring networks are not run through ORD, but they do have some state contacts that they communicate with. Different regions have different relationships with states, as everyone is pressured on money and support.

Dr. Werner asked how the process regarding sensors would work, given that they have all the FRM data, and will soon have sensor data. He stated that it seems to be pretty controversial. Dr. Costa responded that this has begun, and that ACE is trying to get ahead of it, but internally, there are no augmentation of budgets. Dr. Hubbell mentioned that the CAA sets up very specific guidance on what sensors are acceptable, so knowledge gleaned from sensors now will not be useful for regulation in the near-term, but ACE acknowledges the need to work with communities to help them understand how they can use the data.

Dr. Zhao asked whether ACE is tracking how sensor data is used from the Village Green project. Dr. Costa responded that there is a website and an app so people can access the data, and that the primary use so far has been educational. For example, a public library, in Durham, North Carolina, has used the data for science class projects. Dr. Costa mentioned that this investment in education is new, and that ACE has supported teacher training for developing curriculums. Given the abundant interest in OAQPS, Dr. Hubbell noted that ACE is beginning to work with the White House Social and Behavioral Sciences Team to assist in reaching out to communities. Dr. Kenski noted that the goals of the new Science to Achieve Results (STAR) grants focused on community sensors are to not just educate but to also track how the sensor data is used, so there should be more information available from these programs in the near future. Dr. Costa noted that he recently gave a presentation at the National Advisory Council for Environmental Policy and Technology (NACEPT), and it is important for ACE to figure out a way to work with them to develop trust and build a relationship with them.

Dr. Mitchell urged everyone not to discount the value of educational efforts, since the public is not well-versed in air quality issues. A potential model for monitoring systems and what is

useful, similar to a NOAA weather map, could be a powerful tool. Dr. Costa responded that ACE is trying to evolve to these new systems.

Dr. Stacy Katz mentioned that when EPA did initial workshops on sensor technology there was a big issue with a lack of trust. Communities were concerned that their measurements would not be taken seriously, which prompted an RFA for STAR grants. Efforts were made to make sure community, state and local agencies were connected and could build trust in usefulness of data from each agency.

Dr. Aneja introduced the question of whether data collected via "citizen science" methods, which essentially applies to the sensor data, will become accepted by EPA as "real data" that can be used for regulations. Dr. Costa responded that it is an evolutionary process to incorporate data from these methods. Five years ago, OAQPS staff were not ready to accept this kind of data, but now more people are realizing the prevalence of these new methods. He mentioned that it is a legitimate question to ask about the accuracy and precision of all of these kinds of measurements, but that they are improving. He concluded by stating that any data would have to be thoroughly vetted before inclusion into regulatory measures.

Dr. Vette mentioned that there are stringent monitoring criteria for sites. There is also a time element to be considered for regulatory purposes on the order of three years, so there are siting and timing elements. Dr. Hubbell described that ACE can help communities understand how the information can be used (i.e., in health studies or implementation). He mentioned that ACE can guide communities through interaction with communities, presenting options beyond just regulation.

Dr. Kinney suggested that some type of independent testing facility, like what was done for cookstoves, is worth consideration since the Agency is the standard for quality control issues. Dr. Costa mentioned that the EPA's E-Enterprise is a cross-program group created to deal with the issues of how to test and implement sensors. He noted that the South Coast Air District has a platform that they are using to test these sensors. Dr. Costa presented his personal opinion that, given the frequent talk about "big data", they need to determine not only how to store it, but also how to normalize it. He said that new statistical approaches are needed, but is unclear how to invest in this.

Ms. Smith wondered if EPA's funding was a "hot potato issue" because of the population growing more interested in science. More broadly, she asked how EPA makes funding decisions. Dr. Costa responded that it is not an issue now, but it has the potential to be. He mentioned that there use to be a social science investment from EPA, but that it was removed from ORD. Dr. Hubbell mentioned that people were worried that social sciences were going to creep into the overall research program in ways that they did not feel would be productive. Dr. Costa mentioned that ACE is trying to look at how it can empower and learn from communities. He stated that ACE wants people to be empowered to work with what they have.

Dr. Rivers asked about the lifecycle of sensors and whether their quality will degrade as they move to secondary markets. Dr. Costa answered that this issue is evolving, and Dr. Hubbell quickly mentioned that sensors are already publicly available on the online retail site Amazon. Dr. Costa stated that once people have specific data values, they want to use them, regardless of how it fits within other data. Dr. Hubbell explained that because of these issues it is great to incorporate social sciences. He further explained that since some communities can only afford certain sensors, if the cheaper ones are not accepted by EPA, an EJ issue is created.

Dr. Mitchell questioned what the industrial world is going to do with the low-cost sensors and how their data may disrupt this process. Dr. Hubbell stated that ACE will not have control over who uses the sensors and mentioned that as they engage with the entire stakeholder community there will be contested data. There are people currently working on how ACE can handle contested data. Dr. Costa noted that for communities interested in fugitive emissions, EPA is building a website, currently being piloted, that will be accessible to help build trust. He explained that it is a slow evolution because staff have not done this before. Dr. Hubbell articulated that communicating sensor data to users is a four step process: collect data, convert data to a useful health indicator, post data in an accessible way, and then conduct analysis of the data. He noted that different groups are performing each step.

Dr. Geffen asked about the partnership with the National Institute of Health (NIH), and whether their work, in relation to that done by the Agency, is still necessary. Dr. Costa responded that it is necessary. He noted that ACE works with both the NIH and specifically National Institute of Environmental Health Sciences (NIEHS), but NIH is not as focused on education and outreach. He offered an opinion that NIH needs an evolution on how they blend the pursuit of the new with education on what has been achieved. Dr. Geffen commented that Dr. Costa's remarks were very helpful as they consider future operations and gain understanding of how EPA and ACE can be on the forefront of the incorporation of social sciences. Dr. Hubbell noted that NIEHS is working with ACE on the Children's Centers, but it is not pervasive. Dr. Katz pointed out that U.S. Department of Health and Human Services (HHS) is not a singular thing, but rather made up of many institutions. She also noted that there are many potential partners out there and EPA is figuring out how to work with everyone.

Dr. Geffen stated that having been involved with the Department of Energy (DOE), climate programs, and USGCRP, as agencies and groups move in the direction of social sciences, it is helpful for the committee to understand the lay of the land.

Dr. Rivers mentioned that there are theoretical social models about how to coordinate with the public, but these models are old and do not account for current use of social media. He asked if EPA would be interested in these models. Dr. Costa responded that they could be of great use. He went on to say that EPA has a social science internal network, and that Dr. Hubbell was working to get a group of people across ORD who are social scientists. Dr. Hubbell noted that when doing interdisciplinary work, ACE will identify the gaps, and if they can focus on models to address this it could be justified.

Dr. Miller noted that developing a fundamental social science network is a struggle across all agencies. He mentioned the National Science Foundation (NSF) has struggled with funding on that topic. He suggested that putting the need for a social science network in the context of the problem may prove more beneficial. He explained that EPA is maybe not the best example, because it is an applied science foundation, not a fundamental science foundation. He also noted that, except for economics, social science has been a hard sell for funding.

Review of Charge Questions
Dan Costa, National Program Director

Dr. Costa reviewed the charge questions and supporting materials. The charge questions included the following.

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 and a workshop targeting prevention of air pollution-related cardiopulmonary illnesses that both 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?

Dan Costa discussed the reading materials to help address the charge questions, including the Executive Summary and corresponding articles. He stated that the Roadmap is an item on the agenda for the BOSC discussion in January, as well as social sciences and metrics. He addressed the need for the BOSC's input on social sciences, so that the ACE program and ORD could learn from both negative and positive feedback. The Sustainable and Healthy Communities (SHC) research program is also interested in social sciences. Dr. Costa has invited Dr. Andrew Geller, from SHC, to present to the BOSC so they will have the opportunity to understand the SHC program perspective.

Dr. Costa stated that Dr. Dan Ariely, a behavioral economist from Duke University, has agreed to help train ACE staff. Dr. Costa explained that the full-time employees (FTEs) are doing work that is funded from SHC, which is only one level of collaboration.

Dr. Costa stated this is an open discussion on the charge questions.

Dr. Aneja addressed the subcommittee and asked if any member wished to seek clarity on the charge questions.

Dr. Kinney asked how to define social sciences in this context. Dr. Costa suggested to take a broader view. Dr. Hubbell suggested that the definition depends on the problem that is being addressed (i.e., some energy modeling would benefit from economics; but on risk communication, anthropologists might place an important role). He also highlighted that geographers have a growing role in dealing with place, but other specialties include political science, economics and geography. A position was just hired for focused on anthropology and behavioral sciences.

Dr. Arnold commented that it important not to hire based on their work as a social scientist, but to look at the specific problem and see what expertise is needed. He stated it would be more productive to utilize them and their tool sets and the integration of a social scientist does not necessarily solve the problem. Dr. Hubbell responded that the first stage is to understand the nature of the problem and identify the best disciplines to match the problem and it is context (i.e, some disciplines will be more naturally matched). Dr. Arnold asked where the matching of the problem to the need for social science occur (i.e., within in the ACE program). Dr. Hubbell

stated the Agency still needs to investigate that. He acknowledged a gap exists and they need to address it. Dr. Costa stated EPA is addressing this topic during management meetings with Duke University and the University of North Carolina and plan to use their academic expertise. He reiterated that the Agency is identifying social science skills set during the hiring phase.

Dr. Mitchell suggested that the specific person is more critical than their discipline and that as the program grows, it is critical to have lots of contact (i.e., hard science meetings, conferences to integrate social sciences and physical sciences). Dr. Rivers argued that narrowing down the fields of sciences to early could be a problem. Dr. Zhao agreed with the identification of a problem to identify the particular social scientist specialty. He also asked about the process to get a specific social scientist to join the team. Dr. Costa commented that these relationships still need to be determine. Dr. Hubbell stated the integration of the research budget and allocation of time needs to be aligned. Dr. Miller added that discussions with National Center for Environmental Economics (NCEE) have occurred but building a collaborative relationship takes time.

Ms. Smith asked if the Agency has a knowledge of their staff with regard to experience in the social sciences. Dr. Hubbell explained the Agency has initiated a survey and established a Social Sciences Exchange to self-identify employees who have interest in this type of work, their training, research and applications. He stated the Agency has a wide range of specialties, but in small pockets.

Dr. Arnold commented that one place where both physical and social scientists have worked together is the Shared Socio-Economic Pathways (SSPs). Dr. Geffen added the National Center for Atmospheric Research (NCAR) have performed a couple of experiments with how best to integrate the social sciences so the Agency should draw from that experience.

Dr. Werner asked how the role of social sciences fit into the regulatory role of EPA. Dr. Hubble said that the purpose is to enhance and compliment the regulatory program charged with protecting public health. Dr. Costa added the Agency has set it up in a way that the program office does not distract from its primary role. He provided an example how the communication of a public health can be an added benefit. He also invited some people in OAQPS to be available to answer any questions from the members of the subcommittee.

Dr. Aneja asked about the Agency's progress and whether they are beyond the stage of square peg in round hole. Dr. Costa stated the Agency has made progress on who to bring into the organization and by engaging in "outside of the box" thinking. The Agency has also made advances in collaboration with the academic community. The current question to address is: Where do we go from here? Dr. Hubbell commented on the newly created and complimentary ACE centers; where the implementation activities are taking place.

Dr. Geffen differentiated between social sciences and interdisciplinary sciences and is looking forward to more detail. Ms. Smith asked whether the conceptual model makes a distinction between interdisciplinary and multidisciplinary. Dr. Hubbell stated the model uses trans-disciplinary, interdisciplinary, and multidisciplinary. He differentiated multidisciplinary as coming together to discuss a problem and talk about what they found but not really relating the disciplines, and interdisciplinary as developing a common platform and combining new insights across disciplines. Finally, transdisciplinary involves stakeholders and other players. He believed that they can change the approach by integrated problem formulation. Dr. Arnold agreed that the only way to do it is to formulate the problem and attract the right people for the solution.

Addressing the BOSC
Bob Kavlock, Deputy Assistant Administrator, Office of Research and Development

Dr. Bob Kavlock addressed the group via teleconference. He thanked the subcommittee for the work they are doing with BOSC. He provided a few words about the ACE program and their ongoing work including the focus on ozone depletion, the development of models to look at air pollution and climate, the use of hand-held sensors and the efforts with the Village Green project.

Dr. Kavlock reiterated the purpose of the BOSC during this meeting was to discuss the best use of social sciences within the ACE research program. He spoke about how Dr. Courtney Flint and Dr. Robby Richardson helped align the Agency's efforts with public health, community engagement and the SHC program. Historically, the Agency has been really good with building tools and now is trying to integrate these decision making tools with social sciences.

Last month, Dr. Flint and Dr. Richardson conducted a social science "boot camp," and EPA staff engaged in seminars, reviewed case studies, and took an introspective look at their own programs. The NPDs have been tasked to evaluate whether a particular program would benefit from additional social science focus. In January, the BOSC Executive Committee will take another look at this endeavor. Dr. Kavlock mentioned that Tom Burke, Acting Assistant Administrator, has been pushing the public health and community engagement initiative and expressed he was anxious to hear the reactions of the subcommittee.

No questions were asked by the subcommittee.

Presentation on ACE's Conceptual Model
Bryan Hubbell, Science and Policy Analysis Senior Advisor, Office of Air Quality Planning and Standards

Dr. Bryan Hubbell started off his presentation by noting that he is an economist, but his job is to be a science advisor for the Health and Environmental Impacts Division at EPA. His economics work centers around cost-benefit analysis, which requires him to understand science impacts effectively. He explained that when Dr. Costa started moving towards more social science integration, he was nervous about losing the overall mission of protecting public health by reducing exposure to contaminants. He stated that social science and economics programs should complementary, not a substitute.

Dr. Hubbell addressed a central question of his presentation—why focus on social science integration now? He noted that society is faced with many air pollution problems related to air pollution, climate, and energy that are socio-environmental in nature. Before addressing this issue, he explained some constraints. First, EPA did not want to establish a separate social sciences division in ORD. Second, EPA cannot hire exclusively social scientists. Third, it is important to identify the low-hanging fruit to demonstrate the value of this work. He emphasized that they need to highlight the correct social science; not every branch of social science is necessary for every problem. Additionally, some of the social science tools that EPA has available have not been used in these contexts, so they may need to be edited and refined. He then listed five considerations for developing a conceptual model:

1. Define the scope of social science fields that most clearly intersect with natural sciences.
2. Identify stages of research planning and implementation that will most benefit from integration of social and natural sciences.

3. Identify how different approaches employed in social sciences can best be adapted for use in addressing environmental science questions.
4. Evaluate how social sciences can be used to address additional, complementary research questions related to environmental problems and solutions.
5. Understand relationship to citizen science/community-based participatory research.

Dr. Hubbell reiterated that the first element in integrating social sciences was identifying opportunities for social-environmental research, and that EPA should focus on big questions that require interdisciplinary efforts to solve. Also, social scientists need to be involved from the beginning, not just as a final step. Dr. Hubbell mentioned that he had worked with some internal groups who had prior experience with social science integration and observed a common thread among those groups that social science was viewed as an "add-on," which was not useful for engagement. He noted that social science needs to be clearly linked with other science disciplines to inform research planning, implementation, and communication of results. He explained that the best approach was to look for areas of greatest overlap, and gave the example of straight air chemistry as a discipline with little relation to social sciences, and the disciplines of education and institutional arrangement as having little overlap with environmental sciences. In contrast, Dr. Hubbell said that overlap does exist between social and environmental science in areas like epidemiology, emissions, exposures, vulnerability, and risk communication.

Dr. Hubbell said that since interdisciplinary work is very difficult; the work needs to be important and meaningful to keep people engaged throughout the process. He urged people to focus on complex, broad impact problems, and to use collaborative problem formulation. He also recommended selecting a robust project team and preparing them for success, and to follow an interdisciplinary research process. Dr. Hubbell noted that data integration is always an issue when bringing together diverse backgrounds, and gave the example of the National Socio-Environmental Synthesis Center, which has an entire section of staff working to help people integrate their diverse data (survey data, hard data, and GIS data). He stressed the need to develop synthesis and communication products to inform actionable results. Dr. Hubbell explained that people become engaged when they believe their actions will help solve fundamental challenges, so there ought to be actionable results to make people feel like they have made progress. Lastly, Dr. Hubbell mentioned that interdisciplinary research cannot be forced, and there must be a solid infrastructure for hiring and data management.

Dr. Mitchell expressed approval of the model, but observed that there may be a missing piece for receiving feedback, which he thought should be included. Dr. Hubbell agreed that this should be added to the model, especially on long timeframe projects. He further elaborated that while building and preparing research teams is very important, one cannot develop a strong team without a strong team facilitator who has interdisciplinary experience. Since everyone has jargon, which can create a language barrier, projects must have a protocol for communicating across disciplines. Dr. Hubbell acknowledged that this may seem trivial, but that clarifying and defining roles and responsibilities is important, and requires building a culture of trust and respect. He noted that social scientists often feel belittled in collaborative spaces, like they need to convince others of their value, which prevents true collaboration. He recommended a matching exercise to go through each task and address whether it is a good candidate for collaboration.

Dr. Senior said that she was impressed that Dr. Hubbell went through all one hundred forty-three tasks, and observed that it seemed vital to do that as early on as possible in a research effort. She

also noted that while Dr. Hubbell and his team may have ample background in interdisciplinary research, other research teams may not. She asked what such teams should strive to do given their lack of experience. Dr. Hubbell answered that through their boot camp, they wanted to give people enough knowledge for them to do an initial screening. He further explained that generally after an initial screen using tools from a workshop or elsewhere, a larger team should be assembled for the problem formulation.

Dr. Arnold mentioned that the previous examples had been fairly easy, and asked to go over a more difficult example. Dr. Hubbell said no; he reaffirmed that there are more difficult examples, but declined to go through them now due to their complexity. He briefly mentioned climate change, and asked about managing long-term risks. He said that climate change is a complicated, multi-generational problem. Dr. Arnold responded that it will be hard work to integrate research tasks that do not naturally fit into social science frameworks. Dr. Hubbell agreed, and said that his team went through the screening process for all the project tasks in order to make the initial assessment. Dr. Costa concluded by stressing the importance of acknowledging the more difficult examples, but added that there is a need to walk before trying to run.

Dr. Aneja asked how one could demonstrate an improved final product to someone who is analyzing a research plan and identifying potential for social science integration. Dr. Hubbell responded that this is a difficult and unresolved issue. Dr. Arnold quickly noted that one would need a social scientist to identify that potential, and Dr. Hubbell agreed.

Dr. Hubbell continued with his presentation. On communication, he said there must be opportunities to engage in less formal scenarios so that people feel free to explore new ideas. On this point, he gave the example of an old International Business Machines Corporation (IBM) practice with integrated coffee areas. He said the key to moving forward was to have informal weekend long "mashups" with interdisciplinary staff, and to let them collectively solve a problem. He noted that some institutions are already employing this approach, but that it is not yet fully tapped into. He said that social-environmental science exchange is beginning, and was built off a USGCRP program. He also said that ORD does not have sufficient scientists to tackle their research needs, and must draw input from scientists across EPA, or potentially outside of EPA as well.

Dr. Hubbell shifted the focus of the discussion to what must be explored next on this topic. He mentioned that his team is currently focused on simply understanding what they have available through the Social-Environmental Network and Exchange, and is struggling with understanding how the group can operate via an online platform. He mentioned the ACE social science toolbox, which will continue to be updated until they find a better way to share its content.

Dr. Hubbell shifted to discuss cross-training, and said that he did not want to train anyone to be a social scientist, but rather to introduce all staff to what is out there, and begin the conversation on how social science can improve outcomes for natural scientists. He stressed the importance of interdisciplinary social-environmental problem formulation and the need to engage social scientists early in the research design, since otherwise they may not be engaged and feel as though they are secondary team members. He also noted that he investigated a number of different tools for assisting problem formulation, many related to knowledge cartography.

Dr. Hubbell said that he identified seven themes after reviewing the one hundred forty-three tasks, some related to energy and some to climate. ACE is beginning to consider the last of these

themes, which is health messaging and risk communication. ACE has identified candidates for early implementation, including sensors, wildfires, energy efficiency, and long-range climate risk assessment.

Dr. Hubbell covered some recent highlights, such as the ORD initial boot camp. He said the boot camp was small, but interactive, with participants selected as potential early adopters. First, there were two ACE social-environmental workshops on the topic of wildfire risk communication and environmental public health.

Thinking about long-term, Dr. Hubbell said it would be beneficial to establish a social-environmental sciences integration team, which would be a permanent team aimed not at conducting research, but rather for providing assistance to those conducting research. He noted that this would require devoting resources to this project. He stressed the need to adopt a leader embedded within the Agency with experience in interdisciplinary work. This hypothetical team would be involved in a variety of functions, including support for data collection and integration, research support, contract management, facilitation of Institutional Review Board (IRB) and Information Collection Request (ICR) processes, statistical and visualization support, support for synthesis activities, and evaluations of outcomes.

Discussion

Subcommittee

Dr. Werner said that much of the discussion has been binary, and natural and social sciences have been treated as separate. He commented that natural science ranges from mechanical engineering to genetics to other disciplines, and asked how one could manage interdisciplinary efforts among such a broad range of disciplines. Dr. Costa said that he has a history of working on these types of projects, and mentioned animal and human dosimetry. He said the distinction is not binary, and stressed the need to move in the direction of collaboration. Dr. Werner asked Dr. Costa what he had learned. Dr. Costa said that he learned the importance of bringing people together to talk. Dr. Miller said that EPA has had some real successes on this. He conceded that collaboration does not work for everyone, but insisted that when people are brought together from the start of a research effort it tends to work pretty well. Dr. Costa reiterated the need to start small with integration, and said the best course might be to just pick one ACE project to move from walking to jogging and then running.

Dr. Craft asked if there would be value in allowing EPA to allow public comment on identifying areas for collaboration, like how public comment is requested on new projects. Dr. Costa responded that this could work for many research efforts, but maybe not everything. He said it might be good to try.

Dr. Zhao said that he wanted to acknowledge the very detailed work that went into the paper. He explained that part of his research is to get researchers to work together across disciplines, and that he has learned several lessons: 1) integration cannot work top down because the researchers need an incentive to participate, and 2) the transaction cost is in asymmetrical information, so staff need to learn about each other's work. He proposed that the social-environment exchange could be modeled off the NSF Research Coordination Networks (RCN). They start with research topics, then identify potential scientists to work on them, and then build up relationships by going to conferences together. Dr. Zhao also commented on cross-training, saying that people currently educate their doctoral students on the "opposite" science using modules that are heavy on concept and light on methodology (teaching natural science students about anthropology,

etc.). Dr. Hubbell chimed in on the topic of incentives, stressing the need for specific funding for interdisciplinary research, because the scientists will always opt for single discipline work since it is more straightforward and known to them.

Dr. Rivers stressed the need to tackle the concept of rigor related to the social sciences, something that is often considered for natural sciences, but not often for social sciences.

Dr. Aneja asked Dr. Hubbell whether he had received any feedback on how the model will work when applied to other fields, such as chemical engineering, or if it will only work for social-environmental. Dr. Hubbell responded that he hopes the model is universal, and that it was derived from interdisciplinary work. He acknowledged that it will not work for everything, but said that it should be fairly universal. He reasoned that climate models inherently require thinking about large systems, much like those that the social sciences usually tackle. He gave the example of an energy model, which may have an assumption about a fixed parameter, but may be better served by using a social science parameter.

Dr. Aneja said that academics often "live and die" by proposal funding, and asked if there would be additional funding so that outside groups can engage in this conversation, or an incentive for proposals to include engagement with social scientists. For clarification, Dr. Craft asked if Dr. Costa meant something like a request for proposal. Dr. Costa answered affirmatively, saying it is certainly something important that the Agency is considering, and that some programs have already been involved with social sciences. Dr. Geller said that this topic would be discussed further later in the meeting. He noted that ACE has RFAs on understanding non-chemical stressors, cumulative risk assessment, environmental health disparities research, and ecosystem services. Dr. Kavlock commented that many STAR programs do have RFAs with social sciences, but they are struggling to develop an interdisciplinary program. He said that new funding is unlikely, so national programs need to make an investment with existing resources.

Dr. Geffen applauded ACE's effort, mentioned that other agencies are already doing this, and commented that in the coming decades this level of rigor is going to be required and expected of everyone. She also noted that agencies do not need to go public with RFAs, and mentioned as an example that NIH has "glue grants" that provide a small amount of extra funding to defray costs of working together.

Ms. Smith reiterated Dr. Zhao's compliments about the conceptual model. She commented that the model is largely based on case studies of what has succeeded, and said they can also learn from what has failed. She asked if learning from failures has also been considered. Dr. Hubbell said that not as many studies referenced what has failed, but information on that topic was gathered through conversations. He explained that bringing social scientists in at the end of the project, and not having the proper incentive structure are examples of failures to integrate social science.

Dr. Mitchell noted that adding in social sciences is demanded now by New York State Energy Research and Development Authority and others, and that a lone researcher is likely to be a thing of the past.

Presentation on Wildfire Smoke Communication Workshop
Bryan Hubbell, Science and Policy Analysis Senior Advisor, Office of Air Quality Planning and Standards

Dr. Hubbell presented an overview of the Wildfire Smoke and Health Risk Communication Workshop held on September 22 and 23, 2016, at EPA's Research Triangle Park campus, North Carolina. The goals of the workshop were to identify opportunities for research and technological solutions that will improve health-risk communication strategies, increase health-protective behaviors, and reduce public health burden during wildfire smoke episodes.

The primary objective of the workshop was to engage participants in interdisciplinary, multi-stakeholder problem formulation to develop a shared and multidimensional understanding of both the nature of the public health problem associated with smoke exposures that reflects community attributes and experiences, and the types of information and actions related to risk communication and management that might be appropriate for scientific evaluation.

Dr. Hubbell discussed how the intent of the workshop was to close the loop between the effective public health products and outcomes and the research planning and research process by focusing on interdisciplinary social-environmental problem formulation. The workshop was designed to be participant driven. Pre-workshop questions and a mind map exercise were utilized to inform breakout group composition and foci for discussion. Participants were encouraged to explore opportunities for social and natural scientists to engage in problem formulation from the beginning of a research project. Lastly, the workshop included simultaneous observational activities to reflect on the efficacy of the workshop process and foster a network for post-workshop engagement.

The workshop included 67 participants, representing over 20 disciplines, including public health and anthropology, and multiple stakeholder groups representing EPA, state agencies, universities and others.

Dr. Hubbell discussed how a large part of the workshop was the pre-workshop activity – a mind mapping exercise where over thirty individual mind maps were submitted and consolidated into one integrated mind map to identify the five focal areas for breakout groups.

Dr. Hubbell explained that several key gaps were identified and resulting action items were identified, including: Risk Assessment, Government Agency Interventions, Air Quality Awareness, and Coordination between Agencies and Stakeholders.

Dr. Hubbell reported that several potential directions for ORD were targeted, including the application of research from the social and natural sciences towards building trust in impacted communities, e.g., development and delivery of messages for underserved populations, and the need to identify barriers (knowledge, attitudes, resources) to health protective behaviors and explore new technologies to fill in gaps in information to improve message content and delivery.

Lastly, Dr. Hubbell stated that the participant feedback was overall positive and they appreciated the opportunities to interact with a wide variety of disciplines and stakeholders.

Presentation on Cardiopulmonary Health Workshop
Wayne Cascio, Director of the Environmental Public Health Division of the National Health and Environmental Effects Research Laboratory

Dr. Wayne Cascio provided an overview of incorporating public health principles into ACE research and shared information presented during the Environmental Health-Healthcare Workshop held on September 28 and 29, 2016 at EPA in Washington, DC.

Dr. Cascio stated that a public health focus in ACE is consistent with the direction of ORD. He explained that ORD is increasing the public health impact of its research by strengthening public health leadership within ORD, incorporating public health principles into ORD's research, and developing key partnerships with public health, environmental health, and health care communities and federal agencies. Participants of the workshop represented many different disciplines to include federal and states agencies for health and health research and national nursing associations.

Dr. Cascio stated that more effective communication of science among themselves, their partners/clients, and the public is needed. He provided an example of how several workshop participants were unfamiliar with the meaning of "$PM_{2.5}$." He also stated that a better understanding of human behavior and decision-making to achieve greater effectiveness in motivating behavioral changes that will decrease emissions or decrease exposure is needed.

Dr. Cascio discussed the outcome of EPA's first workshop to share multi-stakeholder perspectives on how to improve cardiopulmonary health outcomes through the integration of environmental health, public health, and health care services data and technologies for at-risk patients and populations. The purpose of the workshop was to educate the public on the impacts of air pollution on the heart. The workshop was 1.5 days and included a collaborative portion for federal employees specifically, as well as a graphic artist to create a graphical representation of the barriers and solutions.

Dr. Arnold asked if Centers for Medicare and Medicaid Services (CMS) or insurers require mechanistic explanations for interventions to prevent a clinical benefit or outcome. Ms. Katz added that they might require specific evidence that a particular treatment or intervention will have a particular effect. Ms. Katz stated that the population data exists, but doctors need more evidence on an individual clinical basis.

Dr. Cascio stated that the immediate outcomes of the workshop were the identification of the knowledge gaps and barriers. Such knowledge gaps included the limited knowledge of environmental impacts on cardiopulmonary disease by health care providers, and the lack of environmental public health education in healthcare professional school curricula. Other barriers include limited clinical intervention studies, lack of time for healthcare providers to educate patients, and the lack of incentives for hospital systems to view their mission within the context of health promotion and environmental public health.

Dr. Cascio also identified several opportunities to include the increased knowledge of the association between ambient air pollution and health outcomes, and to continue to promote environmental public health information through continuing medical education, media outreach, and professional school education. One workshop participant suggested approaching the credentialing bodies of medical exams to add test questions to their exams to force the understanding and significance of these issues.

Dr. Cascio discussed the evolving partnership with Million Hearts. Since 2011, this HHS CDC/CMS initiative has been established to prevent heart attacks and strokes. The Million Hearts 2.0, under the direction of Executive Director Dr. Janet Wright, is currently planning new content for the next five years and will consider adding the NAAQS criteria pollutant $PM_{2.5}$ as a modifiable risk factor of cardiovascular disease.

Dr. Cascio explained that EPA is currently engaging with the American Heart Association leadership to address clinical and public health interventions to decrease cardiopulmonary and stroke morbidity and mortality from air pollution.

Dr. Cascio explained that the Affordable Care Act has created new opportunities to improve health. Such factors that contribute to the improvement the environmental health of communities include the use of value-based payment versus fee for service, electronic medical records, community benefits programs, predictive analytics and population health surveillance, and environmental and physiological sensors. Dr. Cascio described how the CMS Readmission Reduction Program has targeted certain conditions evaluated for excess readmission and stated that hospitals should care about these higher risk populations.

Dr. Cascio provided an example from a predictive analytics company, AQI Research to Action, which developed an app to review all the available information on an individual. The app links information on the health record and available air data to inform medical providers and individual whether that person is at risk, and sends alerts to the patient.

Lastly, Dr. Cascio stated that health risks remain and need to be addressed through integrated efforts of public health, health care, environmental health, and individual and community action.

Discussion

Subcommittee

Dr. Zhao asked what the next steps following the workshop are, and how would this link to ORD and increase collaboration.

Dr. Cascio discussed the collaboration being done with the Million Hearts and American Heart Association. He stated that his hope is to direct research projects towards outputs of public health action.

Dr. Hubbell expanded on how the personalized information from the mobile app and portable sensors can be combined and used to improve health outcomes. He stated that both workshops highlighted an overall need to engage in communities, and the importance of establishing a two-way engagement.

Dr. Costa added that EPA needs to move to a level with an actionable component. He stated that the ACE program has learned how to get this information out across agencies and disciplines and build partnerships. Thus, the ACE program has continued to take on a social sciences approach and apply a solutions-oriented approach.

Dr. Kinney stated bringing down ambient air concentrations is a big effort, but individuals could reduce their own levels if they were aware of their sources and had sensors to monitor levels. This would allow us to see immediate health benefits. Dr. Kinney applauded Dr. Cascio's efforts and the strides he is making in the medical community. He restated the role for sensors and their use as a tracking tool to collect data.

Dr. Rivers expressed that he enjoyed his experience with the healthcare workshop and the opportunity it provided to develop relationships between the Agency and the people in the field. He provided an example of establishing a connection to assist a graduate student that works with GIS.

Presentation on Connections with SHC Program
Andrew Geller, Deputy National Program Director, Sustainable and Healthy Communities Research Program

Dr. Costa introduced Dr. Andrew Geller. Dr. Geller has worked with the SHC program and has served as the lead author on the EPA EJ Roadmap. SHC is responsive to a number of EPA strategic priorities, specifically working to make a visible difference in communities, cleaning up communities and advancing sustainable development, and working towards a sustainable future. Research is divided into four research themes: decision support tools, community well-being, sustainable approaches for contaminated sites and materials management, and integrated solutions for sustainable communities. Dr. Geller noted that SHC defines sustainability using three principles: interconnectedness, the long-term, and well-being.

Dr. Geller noted that environmental exposure needs to be considered in the context of the community it occurs in. EPA will soon be initiating work on understanding the full exposure impacts on children's health, particularly including social indicators. Dr. Geller noted that it is also important to understand the uses and valuation of ecosystem services.

Dr. Geller noted that SHC is currently trying to define their social science needs. Those needs include identifying the beneficiaries of ecosystem services, understanding how they are valued by different groups, and learning what the benefits are from improved ecosystem management. He noted that communities are experimenting with sustainable solutions, but SHC does not know all of the steps that have been taken. Dr. Geller noted the need to identify and learn from these experiments. Social science is also needed to assess climate change adaptation and mitigation, and to understand who is engaged in these conversations on infrastructure. He also noted the need to understand who is benefiting from the actions being undertaken. Overall, he mentioned a need for SHC to be asking who the solution serves for each effort and the actors in each discussion.

Discussion
Subcommittee

Dr. Mitchell sought clarification on the systems approach that was discussed in the last ACE Subcommittee meeting, and where it fits within the new approach. Dr. Hubbell responded that EPA needs to be more explicit in the systems approach, but the aim is to have a combined system considering environmental and social sciences. Dr. Mitchell then asked if there was such a thing as a "system scientist." Dr. Hubbell noted that he was not sure what that would be exactly, but thought someone who thinks broadly about how things connect and how they fit with each other is absolutely necessary. He noted that this involve not only problem formulation, but also involves work on combining research designs and synthesis as part of research design. He noted the lack of a consistent approach to look at a system of research.

Dr. Costa mentioned continued internal conversations on synthesis. He proposed a continued question of how to reward collaboration. Dr. Costa thought of publications as a "gorilla in the

room." Though they have tried to change this, expectations vary by department and by researcher. He said that this problem has yet to be solved.

Dr. Geller noted a few approaches EPA has for systems problems. The first is to use systems modelers, who convene groups, listen to the issues, and then create a model that allows the users to conduct scenario analysis. The second, used by SHC, is to use integrated multi-objective decisions, which can use structured decision-making analyses, such as health impact assessments.

Dr. Craft expressed a desire to return to the sensor revolution discussion. She suggested incorporating how to handle unintended consequences into the discussion. As an example, she noted the Google cars equipped with air quality sensors driving around Oakland. The Environmental Defense Fund has collaborated with Kaiser Permanente on this project to see health impacts on a micro-scale. However, they are currently not seeing results, and the group hypothesizes that this is because their data is too granular. Dr. Craft expressed a desire for the committee to be aware of this issue. Dr. Costa explained that there is a tendency to think of two dimensional systems while ignoring the third dimension of time. For example, ozone exposure to asthmatics; they may not respond immediately, but studies show that they are more likely to react to the same triggers in the future. He noted another example of diesel exposure in rats. Dr. Hubbell noted that at a very fine level, where someone lives is only captured, not a person's movements throughout the day. At less granular levels, this information becomes essentially an average of their movements throughout the day. There are examples in the social life of sensors paper, but they cannot think of everything in advance.

Dr. Kenski mentioned that she thinks this is a fantastic approach, and that EPA has done great work over the past year. She noted that going back to the first meeting, there was considerable concern from the panel on resetting priorities and the loss of focus on some of ACE's traditional programs. With the new approach to incorporating social sciences, there has been discussion on new hires, but it is also a zero-sum game. Dr. Kenski sought comment on where the money is going to come from, and who could potentially lose in this scenario. Dr. Costa noted that this is a very legitimate and serious question. ORD had over 200 hires this past year, of which only a handful were social scientists. The drivers to meet fundamental responsibilities are still there, but they are trying to change the mindset on social sciences. They do not want to shortchange innovation in how people think. As examples of innovation, Dr. Costa noted the change in the ozone exposure standard from one hour to eight hours, and the development of Integrated Science Assessments. Dr. Ron Hines, the Associate Director for Health at the National Health and Environmental Effects Research Laboratory (NHEERL), responded to the question about the zero sum game. He noted that ORD went through an exercise over the past two years to develop an ORD employee enhancement plan. This assessed their status at the time, and where they wanted to be in 5 years, and where they had too much capacity in terms of human resources. As part of this effort, ORD has begun to transform their workforce as departures happen naturally. Dr. Wayne Cascio followed up by noting that the reshaping of the workforce also applies to traditional types of toxicology. Dr. Hubbell mentioned that he is hoping they can take a complimentary approach between social sciences and traditional EPA responsibilities. He noted that it is a zero-sum game in terms of who they hire, but not in terms of what they learn.

Dr. Kinney mentioned that he is intrigued by the well-being topic area, and wondered if it can be considered individually or if it needed to be considered with other more quantifiable health impacts. He specifically brought up the example of the health benefits of green spaces. Dr. Geller

noted that they are pushing for well-being, but also that they are aware that anything that has quantifiable impacts is much more easily incorporated into decision-making formats.

Dr. Geffen said that she heard there was initial resistance to the incorporation of social sciences, and wondered if Dr. Geller had experienced this same resistance. Dr. Geller noted that their work with the social sciences has grown more organically, and that a lot of the work has been done through retraining. He noted that employees in the ecology department have become experts in well-being, and that employees working in ecosystem services tend to gravitate towards system approaches. Dr. Geller noted an example of success in Guanica Bay in Puerto Rico, where there is an effort to save a coral reef. By working with locals, it was concluded that reef conservation would have impacts on all of their human systems, such as agriculture, sewage, and more. As a result, the decision context became much larger than just coral conservation. He noted that a large part of the decision context is how to incorporate community, and that there is a need to understand that different communities value all factors differently.

Dr. Costa thanked Dr. Geller for coming, and mentioned that he wanted to provide context on the larger work that is being done and how it can be integrated into the conversation. Dr. Geffen noted that it speaks to how the programs are talking and sharing lessons learned, and that is a positive sign as change is happening for the program. Dr. Costa noted that they are moving more towards big national issues, where everyone has a stake. As a result, they are looking for ways to drive even more cross-departmental communication to tackle large problems such as wildfires. Dr. Hubbell reiterated the need for greater communication to solve problems of broad national significance. Dr. Aneja thanked Dr. Costa, Dr. Hubbell, and Dr. Geller for their presentations.

Discussion of Responses to Charge Questions
Subcommittee

Dr. Aneja noted that the required final product is a response to all three charge questions, so the group planned to spend the remainder of the day discussing each charge question.

Dr. Aneja began by reading the first 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?

Ms. Smith requested that the group first capture the strengths of the model. Dr. Werner thought that this model would allow ACE to address environmental issues that would not normally be addressed in the normal process of setting priorities. Dr. Craft commented that another strength is the encouragement of executive level and Agency support. Dr. Arnold added that a strength is that the model builds on strengths that are already there. The model takes advantage of places where ACE has already been successful, and is integrating social sciences into areas where it can work. Dr. Werner noted that the sensor example discussed earlier does not fit anywhere else. Dr. Senior noted that an obvious strength is that the model starts with program support and training, which is a necessary step for effective implementation. Dr. Zhao commented that the document is very comprehensive, and that ultimately the whole is going to be much larger than the sum of the parts, given the complimentary nature. Dr. Geffen commented that the approach will allow the Agency to have more impact in terms of the solutions they offer. Dr. Kenski commented that

the model creates the potential to reach a whole new audience. Dr. Mitchell noted that the model can be applied to a variety of different scenarios. Dr. Geffen noted that because it is codified, different groups can use it for different problems. Dr. Craft commented that the case studies provide people with examples on how the model is applied. Dr. Aneja asked if the model is codified, or if it is a bottom up approach. Dr. Geffen commented that her understanding is that it is codified because it has discreet steps. Dr. Hubbell agreed with Dr. Geffen. Ms. Smith noted that the emphasis on good team facilitators is a strength of the model, and points toward an opportunity to identify people who are interested in integration science. Dr. Geffen noted that given the way the model is laid out and its collaborative nature, participation does not have to be exclusively limited to EPA scientists. She noted that this allows for clear opportunities for partnership with already well-defined roles and needs.

Dr. Aneja turned the conversation to the weaknesses of the model. Dr. Mitchell noted that it is key to make sure that the right individuals are involved at the beginning of the project. He also mentioned that there is a need for iterative processes within the model, which would allow for response to feedback. Dr. Rivers reiterated the need for iteration by noting that the model does not leave much room for surprises. Dr. Senior noted a worry that this could become a very top-down process. Dr. Zhao mentioned a need for a step to involve researchers early, and also a need to build in an assessment of capabilities. Dr. Geffen noted that this model appears to be a large culture change, so there is a need to take appropriate steps to make sure that the changes are sustainable. Dr. Costa noted his agreement. Dr. Hubbell mentioned his hope that the social science exchange will help address this need. Dr. Geffen noted that there is a large body of work on organizational change management, and suggested that EPA look at this. Dr. Hubbell noted that they are thinking about these issues. Dr. Costa mentioned that they have been looking internally to understand how they can change. Dr. Rivers noted that there is an "otherization" of social sciences, and thought that this should be addressed before going to the community. Dr. Werner inquired what percentage of ACE programs are intended to be multidisciplinary. Dr. Costa responded that he thought it would have implications across all of the work. Dr. Hubbell noted that CIVA and PEP are two areas that would receive a lot of attention, and thought that efforts would be targeted to certain programs. Dr. Miller noted that in addition to the parts of PEP that have been discussed today, there is a lot of decision science and community impacts within CIVA. Dr. Hubbell said that this also shows up in the new climate roadmap. Ms. Smith noted that she did not think that all of the implementation steps discussed in the paper were highlighted at the end of the paper. Dr. Zhao noted that for this model to work, you must be able to attract good social scientists, and inquired about the recruitment process. Dr. Costa noted that he agrees with this issue, and wants to engage in conversations on this issue during the application process. Dr. Kenski inquired about how the Agency can train and encourage their current staff to be happy with the culture change that this integration of social sciences would require. Dr. Costa noted a similar culture change five years ago when they departed from a typical academic research style. Dr. Werner noted that he was uncomfortable with the binary definition of natural and social scientists, as it creates a wall between the capabilities. Dr. Hubbell noted that he attempted to address this issue in the model, but would be happy to hear suggestions on how to improve this. Dr. Werner suggested that they can use the names of specific fields of interest rather than the larger terms of natural and social scientists.

Dr. Aneja transitioned the conversation by reading the second 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 and a workshop targeting prevention of air pollution-related cardiopulmonary illnesses that both 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?

Dr. Mitchell made two suggestions. First, he thought that it would be helpful to see how closely the workshop followed the model that was developed. Second, he explained that while the committee had discussed the good aspects of the model, it would be good to know what was bad about it as well. Dr. Kinney commented that climate is a huge issue, so it seems that it would be necessary to develop a case study around that topic, perhaps on cars or bike share programs in cities. Dr. Geffen mentioned that it would be important to understand what else is going on in the climate space, especially among programs like USGCRP. Dr. Aneja said that he heard that morning that renewable energy capacity had exceeded coal power worldwide, and that this could make an interesting case study. Dr. Geffen noted that this case study would be good if they wanted to include energy in the portfolio. Dr. Zhao commented that it was not clear how this workshop contributes to the cultural change in EPA. He requested clarification on how ACE researchers are involved in these workshops. Dr. Geffen expressed agreement and then noted a need to identify next steps on how the broader questions are involved. Dr. Senior asked if there are incentives in place for ACE staff to participate in these workshops. Dr. Geffen noted that the workshops have held in more newly-defined areas, but questioned if they could be applied to existing programs. Dr. Kinney commented that he liked the idea of targeting the topics of climate and sensors, but suggested the need to sharpen the focus even further within those topics. Dr. Kenski inquired if it would be possible to piggyback on the community and monitoring grants. Dr. Costa mentioned that they are looking for some of those opportunities right now, and partnering with the Open-source Challenges. Dr. Miller noted there is always significant internal communication before any of the mentioned programs are initiated.

Dr. Aneja read the third 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?

Dr. Costa noted that this may be difficult because the committee has not seen the other programs. Dr. Kinney asked to what extent the extramural research topics are informed by social sciences in the problem definition. Dr. Hubbell mentioned that there are RFAs coming out that involved significant conversation with social scientists on how to make those research topics more multidisciplinary. Dr. Senior noted that she was not familiar with how extramural research is disseminated and used by ACE researchers. She mentioned that funding extramural interdisciplinary research may be a good way to start the cultural change. Dr. Costa noted that the timeline for external research from start to finish is usually 5 years or more, so this process can be slow.

Dr. Geffen put forth a number of ideas for consideration. First, she asked which professional societies EPA staff attend, and questioned if they can be encouraged to participate in interdisciplinary sessions. Second, she proposed a webinar or seminar series using external and

internal speakers. Third, she suggested partnering with one or two key professors who have students that want to be mentored. Dr. Rivers mentioned that interdisciplinary professionals are usually 10 years into their career, and thus have less incentive to come to EPA. Given this, he asked what ACE can do to grow these people instead of attract them from elsewhere. Dr. Geffen noted that some universities are producing interdisciplinary students. Dr. Rivers commented that there has been a pushback on interdisciplinary backgrounds in the academic world. Dr. Geffen noted that these interdisciplinary professionals are more highly valued outside of academia. Dr. Mitchell offered that there are programs at his university that require students to take both natural and social sciences. Dr. Hubbell asked the committee if it is more valuable to learn interdisciplinary skills in an academic setting or a professional setting. Dr. Geffen commented that there are lots of ways to gain expertise, and they do not necessarily have to cost money given some creativity. Dr. Zhao noted that in his experience promoting interdisciplinary research, it is easier to talk about it than it is to do it, so it is valuable to just start doing it. He said that it is wise to target the low-hanging fruit first, and then the work can grow from there. Dr. Kinney commented that the National Aeronautics and Space Administration (NASA) Air Quality Applied Sciences Team has a model of funding for research teams that could be emulated by EPA. Dr. Werner noted that there seems to be an opportunity for more outreach to high schoolers and teachers to highlight the opportunities they can have in the future.

Dr. Aneja questioned how reactive nitrogen water impacts fit in with this discussion on social sciences. Dr. Costa noted that this area is ripe for the kind of work they are looking to do. Dr. Rivers mentioned that innovations may come from involving social scientists who have no exposure to environmental issues but work with the affected communities. Dr. Craft noted that identifying vulnerable communities, such as poor communities, can be used to find hot spots for these issues.

Wrap-up and Adjourn
Viney Aneja, Chair, Tim Benner, Designated Federal Officer

Dr. Aneja explained that there would be one hour tomorrow morning for additional review of the charge questions. He mentioned that the rough notes from today would be sent out tonight. Dr. Benner dismissed the group for the day.

Wednesday, October 26, 2016

DFO Reconvened Meeting, Attendance
Tim Benner, Designated Federal Officer

Dr. Aneja and Dr. Benner welcomed everyone to the second day of the meeting. Dr. Aneja stated that the group had an hour to deliberate as they see fit. He asked the group if they had any comments/questions/clarifications related to discussions and charge questions from the first day. He told the members that he hoped that the group had decided which charge question sub-group to join.

Subcommittee Discussion
Subcommittee

Dr. Geffen asked a question, related to the third charge question, about whether there were any barriers or restrictions to engaging with outside organizations. Dr. Costa responded that there are no restrictions that the committee should be aware of. He noted that the other programs have not given as much thought to potential collaborations, so it would be great to think of another

crossover example like the nitrogen water example. Dr. Hubbell noted that he would like to have more opportunities to get people together in creative environments, and he would welcome any ideas on how to accomplish that. Dr. Miller additionally noted that as ACE moves into social sciences, it can be easy for the research to cross into areas that are perceived as policy issues. He noted that ACE needs to be careful when approaching conversations that could be perceived as policy-related, given the sensitivity from many offices on this issue. Dr. Hubbell responded that one way to address this issue is through integrative problem formulation. By bringing in stakeholders early, everyone is involved in the conversations, which avoids this sensitivity issue.

Dr. Mitchell commented seeking clarification on who within the group has a social science background, and sought to understand whether the committee needs to expand to include more social sciences expertise. Dr. Benner noted that Dr. Rivers has a strong background in social sciences, and Dr. Zhao is an economist. Dr. Geffen asked whether a Master of Business Administration (MBA) counts as social sciences, given the focus on organizational and operational approaches, and her history of running interdisciplinary teams. Dr. Aneja commented that the committee may be able to get by. Dr. Geffen added that the committee may be able to expand in a year. Dr. Arnold commented that part of the discussion from the previous day was to avoid being bound by disciplinary titles. He noted that the committee does not just need someone working in a specific university department, it needs someone who has relevant experience in these areas. Dr. Costa noted as well that this meeting is focusing on social sciences, and it will be a component moving forward, but it will not necessarily be the only topic of conversation in future meetings.

Dr. Aneja then divided the committee into groups to discuss each charge question. The groups for each charge question were:

- Charge Question 1: Drs. Charlette Geffen, Constance Senior, Art Werner
- Charge Question 2: Drs. Elena Craft, Jeffrey Arnold, and Patrick Kinney
- Charge Question 3: Drs. Donna Kenski, Louie Rivers III, and Myron Mitchell

Dr. Aneja noted that he had received comments from Dr. Zhao, who had to leave early, and that those comments would be distributed to the committee.

EPA Response to Subcommittee Questions
Dan Costa, National Program Director

Ms. Smith sought clarification on the last charge question report, as there was a request for specific recommendations. She noted that these charge questions seem to lend themselves less to specific recommendations, and wondered if there were specific desired outcomes. Dr. Costa responded that ACE tried to be broad enough to give the committee freedom to respond as it felt necessary, and that it may be best to respond in whatever way is most appropriate to respond to the core issue of each charge question. Ms. Smith asked if in addition to opportunities to get people together, there were any other specific requests. Dr. Hubbell said any recommendations for the best ways to move into the implementation phase would be welcome. Dr. Costa noted a need to understand the necessary empirical design. Dr. Hubbell further noted that they had presented two examples in the meeting, but the processes will be repeated in the future, so any recommendations on what should be changed and what should be codified would be helpful. Dr. Miller added that many charge questions are about whether the program is moving in the right direction; however, they are currently looking for expertise on the subject area, rather on the

program itself. Dr. Hubbell reiterated his desire to hear about any examples they should be exploring.

Ms. Smith noted that during the last charge question process, the committee learned that when making a recommendation, EPA was obligated to respond to it. The committee provided a lot of recommendations last time in an attempt to be comprehensive. A lesson learned for the committee is that it is important to prioritize, so rather than trying to get ten recommendations down, it would be better to prioritize the best three. She asked if this aligned with ACE expectations. Dr. Miller commented that ACE needs to respond to recommendations about how they run the program, but suggested options do not require formal feedback from ACE.

Dr. Aneja asked for clarification regarding the request for responses to the charge questions and whether specific recommendations not being requested. Dr. Costa responded that recommendation requests are embedded within the charge questions.

Dr. Werner asked whether charge question three should be limited to only near-term opportunities in ACE and other ORD research programs. Dr. Costa responded that the committee could consider a broader context.

Dr. Aneja noted that Dr. Zhao's recommendations had been distributed.

Ms. Smith asked if the committee could write anything new they think of in their recommendations afterwards. Dr. Benner replied that the records will be public, so anything new is welcome.

Dr. Aneja commented that the committee should now break up into the charge question response groups.

Public Comment Period
Tim Benner, Designated Federal Officer

Dr. Benner opened up for public comment. No response was received, so the comment period was closed.

Subcommittee Discussion and Writing
Subcommittee

Dr. Aneja welcomed the subcommittee back from their group discussions and asked a representative from each group to summarize the highlights of the response to their respective charge questions.

Charge Question 1

Charge Question 1 was "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?"

The members were Drs. Charlette Geffen, Constance Senior, and Art Werner.

Dr. Senior summarized the strengths and weakness of the conceptual model for interdisciplinary research. The strengths of the model recognize the careful attention that was given to best practices of interdisciplinary collaboration. Dedicated funding and personnel for interdisciplinary

research projects was acknowledged as necessary for the successful implementation. They also stated that the model allows for clear opportunities for partnership and collaboration among social and natural scientists, including those inside and outside EPA. The weaknesses were stated as suggestions for modification of the conceptual model. Putting the model into practice will require a cultural change in how ACE research takes place. EPA should articulate how the change will occur, and consider using organizational change management techniques. The need for strong leadership at the problem formulation stage cannot be underestimated. ACE should clarify what the objectives and tasks for the network are, as well as incentives and rewards for people to participate. The model implementation needs to be an iterative process with built-in mechanisms for modification, evolution, and feedback throughout the project.

Charge Question 2

Charge Question 2 was "The ACE program is piloting several applications of the conceptual model, including an interdisciplinary problem formulation workshop on wildfire smoke risk communication and management and a workshop targeting prevention of air pollution-related cardiopulmonary illnesses that both 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?"

The Subcommittee members were Drs. Elena Craft, Jeffrey Arnold, and Patrick Kinney.

Dr. Craft summarized the draft response to Charge Question 2. Given the model presented in the executive summary, the problem formulation element is represented as an amalgamation of social sciences network and the natural sciences network. To facilitate problem formulation within the program, EPA might consider providing some criteria. In the wildfire smoke and health risk communication example, the development of the workshop seemed to occur in a serendipitous way as opposed to following a specific paradigm of program development. Having some criteria that could be used in problem formulation may aid programmatic development of problem statements and could serve as a guide for interdisciplinary social science research. In terms of determining whether project has met goals, EPA may consider establishing specific metrics by which to measure goals.

Charge Question 3

Charge Question 3 was "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?"

The members were Drs. Donna Kenski, Louie Rivers III, and Myron Mitchell.

Dr. Rivers summarized the draft response to Charge Question 3. When social science is integrated into ACE projects, it must meet the same level of rigor as the natural sciences. In order to ensure that ACE supports high quality efforts, there is a need to develop metrics and expertise in reviewing the quality of social science research. Partnering at the problem formulation stage with the right team is important to help ACE researchers integrate the social sciences into new programs. ACE researchers should be incentivized to attend interdisciplinary conferences. Some examples of how this might be achieved would be publicizing a wider range of conferences within ACE and providing supplemental travel funds for one additional conference each year that an individual has not previously attended. ACE researchers would

benefit from exposure to how multidisciplinary teams have solved problems. As projects are piloted within ACE (e.g., wildfires risk communication), the outcomes (what worked and what didn't work) should be communicated more broadly within ACE in an interactive workshop format.

Wrap-up and Adjourn

Dr. Aneja noted that the committee had accomplished a lot in this day and a half. Ms. Smith commented that the problem was very challenging, and it was very rewarding for the committee to think through this issue. It is useful to have a defined issue to think about, which leads to a more constructive meeting. Dr. Aneja extended thanks to the members of the subcommittee, EPA, and the contractors. In two weeks, the committee will provide the deliverables, and Dr. Aneja asked when EPA wanted them. Dr. Benner noted that the hard deadline is to have it into the BOSC Executive Committee. The report would be particularly useful for the Executive Committee BOSC meeting in January. Dr. Hubbell noted that crossover points are useful, such as the metrics that can be used to reward people for engagement. Dr. Miller requested that as recommendations are made by the committee, that they think about what resources would be required to implement. Dr. Aneja noted that the committee can send a draft to Dr. Benner. Dr. Geffen inquired if the materials that each group sent in would be compiled and sent back out. Ms. Smith commented that each subcommittee can continue polishing what they have as a small group. Dr. Aneja commented that the polished group input can be sent to Dr. Benner before Thanksgiving, and then Dr. Benner can send out a complete draft after the first week of December. Dr. Aneja noted that he will send an email through Dr. Benner to everyone in order to clarify the timeline. They will work to get the report out to EPA by the end of the first week of December. Dr. Aneja asked if there were any last comments from the group. Dr. Costa extended a thanks to everyone for being there.

Dr. Benner thanked the committee for giving their time and for coming down to make a lot of progress in a short amount of time. The meeting was adjourned.

Appendix A: Agenda

United States Environmental Protection Agency
Board of Scientific Counselors (BOSC)
Air, Climate, and Energy (ACE) Subcommittee
Meeting Agenda – October 25–26, 2016
Research Triangle Park, North Carolina

TIME	TOPIC	PRESENTER
Tuesday, October 25, 2016		
8:00 – 8:30	Registration	
8:30 – 8:45	Welcome, Introduction, and Opening Remarks	Viney Aneja, Chair
8:45 – 9:00	DFO Welcome and FACA Rules	Tim Benner, DFO
9:00 – 10:45	Program Update and Discussion	Dan Costa, NPD
10:45 – 11:00	Break	
11:00 – 11:30	Review of Charge Questions	Dan Costa, NPD; Subcommittee
11:30 – 12:30	Lunch	
12:30 – 1:30	Presentation on ACE's Conceptual Model Discussion	Bryan Hubbell, Senior Advisor, OAQPS; Subcommittee
1:30 – 2:30	Presentation on Smoke Communication Workshop Presentation on Cardiopulmonary Health Workshop Discussion	Bryan Hubbell, Senior Advisor of OAQPS; Wayne Cascio, Director of EPHD, NHEERL; Subcommittee
2:30 – 2:45	Break	
2:45 – 3:15	Presentation on Connections with SHC Program Discussion	Andrew Geller, Deputy NPD of SHC; Subcommittee
3:15 – 4:45	Discussion of Responses to Charge Questions	Subcommittee
4:45 – 5:00	Wrap-up and Adjourn	Viney Aneja, Chair and Tim Benner, DFO

TIME	TOPIC	PRESENTER
Wednesday, October 26, 2016		
8:30 – 9:30	Subcommittee Discussion EPA Response to Subcommittee Questions	Subcommittee; Dan Costa, NPD
9:30 – 9:45	Public Comment Period	Tim Benner, DFO
9:45 – 12:00	Subcommittee Discussion and Writing	Subcommittee
12:00 – 12:15	Wrap-up and Adjourn	

Breaks at the discretion of the chair.

Appendix B: Participants

BOSC ACE Subcommittee Members:

Viney Aneja, Chair
Sandra Smith, Vice Chair
Jeffrey Richard Arnold
Elena Craft
Charlette A. Geffen
Donna M. Kenski
Patrick Kinney
Myron James Mitchell
Louie Rivers III
Constance Senior
Art Werner
Jinhua Zhao (*present on Day 1 of the meeting only*)

EPA Designated Federal Officer: Tim Benner, *Office of Research and Development*

EPA Presenters:

Dan Costa, *Office of Research and Development, National Program Director for the Air, Climate, and Energy Research Program*

Bryan Hubbell, *Office of Air Quality Planning and Standards*

Wayne Cascio, *Office of Research and Development, National Health and Environmental Effects Research Laboratory*

Andrew Geller, *Office of Research and Development, Deputy National Program Director for the Sustainable and Healthy Communities Research Program*

Other EPA Attendees:

Lisa Baxter	Stacey Katz	Laurel Shultz
Ann Brown*	Nicole Kim	Alan Vette
Beth Hassett-Sipple	Andy Miller	Chris Weaver*
Ron Hines*	Gail Robarge	

**present on Day 1 of the meeting only*

Other Participants by Phone:[#]

Ruth Greenspan Bell (*Wilson Center*)	Rich Callan	Carl Mazza
Bill Benson	Sherri Hunt	Carlos Nunez
		John Shoaff

[#] *EPA staff unless otherwise noted*

Contractor Support: Sandra Chambers, Kevin Kurkul, and Catherine Smith, ICF