U.S. Environmental Protection Agency (EPA) Board of Scientific Counselors (BOSC)
Air, Climate, and Energy Subcommittee

Face-to-Face Meeting Minutes

June 18-19, 2015

Date and Time: June 18, 2015, 8:30 a.m. to 4:45 p.m.; June 19, 2015, 8:30 a.m. to 2:30 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. Draft charge question responses are provided in Appendix C.

Thursday, June 18, 2015

The meeting generally followed the issues and timing as presented in the agenda attached to this meeting summary.

Welcome, Introduction, and Opening Remarks

Dr. Viney Aneja, Chair

Dr. Tim Benner, 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 and stated that he was delighted they have all embarked on very important issues that confront environmental concerns of the nation. He stated that everyone was attending to examine the ACE program and to deliberate on the five charge questions that have been provided. He noted they are at liberty to discuss them either as a subcommittee or raise issues with EPA officials individually, including with Dr. Dan Costa, the National Program Director for EPA's Office of Research and Development's (ORD's) ACE research program.

Dr. Aneja requested each subcommittee member introduce himself or herself. Dr. Aneja started by saying he is a professor at North Carolina State University. Ms. Sandra Smith is with AECOM in Austin, Texas and has a background in toxicology and human health risk assessment. She has also done a lot of work with air emissions and deposition. Dr. Jeffrey Richard Arnold is a Senior Scientist with the U.S. Army Corps of Engineers. He directs the Corps' climate change programs and worked at EPA ORD for a number of years. Dr. Charlette A. Geffen is the Division Director of the Pacific Northwest National Laboratory. She focuses on environmental risk assessment and environmental policy, and for the past 10 years, has been running an atmospheric science program. Dr. Donna Kenski is the Director of Data Analysis at Lake Michigan Air Directors Consortium. Their mission is to help the six states around Lake Michigan with any type of technical analysis to support their state implementation plans to meet air quality standards. Dr. Patrick Kinney directs a climate and health program at Columbia University and has worked on many standard setting reviews. Fifteen years ago, he became interested in climate and how climate and air pollution interact. Dr. Jinhua Zhao is a professor of economics and a director of the environmental science and policy program at Michigan State University. Dr. Art Werner is with AMEC Environmental & Infrastructure and has been doing air pollution related work for 40 years, including work with the air laboratory at EPA. He assists with emissions, emission inventories, and peer-review work. Dr. Constance L. Senior is with ADA-ES, Inc, which makes air pollution control equipment for industrial sources and power plants. Her area of expertise is in mercury emissions from combustion sources and her interests include air pollution and the causes and control of air pollution. Dr. Myron James Mitchell is a professor at SUNY in Syracuse with interests in biogeochemistry, forested ecosystems, air pollution effects, and climate effects. After the last member introduction, Dr. Aneja thanked the members and noted that Dr. Elena Craft with the Environmental Defense Fund was unable to attend the meeting in person.

Designated Federal Officer (DFO) Welcome
Dr. Tim Benner, DFO

Dr. Benner introduced himself as the DFO for BOSC ACE. 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). He then covered some basic rules: all meetings are open to the public per requirements of FACA and include opportunity for public comment, minutes are being taken by EPA's contractor and would be made public on the BOSC website after being certified by the chair, and an electronic public comment docket had been established in the *Federal Register* and no comments had been submitted to that docket. He reminded the audience 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 15 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 June 19, 2015. He noted public comments would be limited to three minutes and the phone line was for listening only, with the exception of Dr. Craft. All attendees on the phone line were told to email benner.tim@epa.gov for a record of attendance. To ensure everyone could hear, he encouraged all subcommittee members and participants to use microphones whenever they spoke and all teleconference participants to remain muted, with the exception of Dr. Craft, and to use land lines when possible. Dr. Benner explained the location of the poster session.

Review of Charge Questions
Dr. Viney Aneja, Chair

Dr. Aneja introduced the charge questions and explained that was a primary change to the meetings. He suggested finding the best approach to these questions (e.g., whole versus small group, discussion versus written responses). The charge questions considered included the following.

1. Given the research objectives articulated in the Strategic Research Action Plan (StRAP), are the topics and project areas planned and organized appropriately to make good progress on these objectives in the 2016-2019 time frame?
2. How effective are the approaches for involving the EPA partners in the problem formulation stage of research planning?
3. How well does the program respond to the needs of EPA partners (program office and regional)?

4. Please comment on the quality of the products delivered by the program. Are there additional approaches that could be taken by the program to ensure that its products are of high quality?
5. How well have we translated research findings and understanding for the end-users? How can we improve our ability to translate research findings and understanding for end-users in the future?

Program Summary and Discussion of Materials Provided
Dr. Dan Costa, National Program Director of EPA ORD ACE Research Program

Dr. Costa thanked the subcommittee members for agreeing to join despite the drawn out certification process. He began by explaining that there are six research programs, each with its own BOSC subcommittee. There is also an executive committee of the BOSC, which includes Dr. Aneja and Ms. Smith. All six research programs will go through a process similar to that of the ACE BOSC. The BOSC has been around for 15 years. In the past, there were 16 programs and the meetings were labor intensive, comprised of two and a half days. Six to seven years ago, they reconstituted into six major programs. Instead of having a major review every 4 to 5 years, the goal was to have a more intimate relationship with the subcommittee over 3 to 5 years. The subcommittee could then be advisory and provide critical review of the direction of the program.

Dr. Costa apologized for the late delivery of the immense amount of material. He explained there would be time during the entire meeting to address questions. He stated that the interdisciplinary nature of this subcommittee gives a program like ACE the opportunity to think broadly as they approach the many questions that lie ahead. In contrast to previous meetings, there would be a great amount of time for discussion and the meeting was organized in the context of the charge questions. The importance of open and frank conversion was stressed. Dr. Costa began by reviewing the highlights of the program and referencing the ORD 101 that Dr. Robert Kavlock presented as well as ACE 101. He referred to an internal "Jamboree" meeting held two weeks prior to this meeting, the booklet from which provided a program summary.

Dr. Costa then addressed the ACE StRAP for 2014–2018 and explained that ACE primarily resides in strategic goal 1, "addressing climate change and improving air quality." He stated that climate impacts everything we do in the 21st century, and it could be argued that climate will affect all programs at ORD. From an air perspective, the interplay between climate and air is mediated largely by energy choices. The ACE "Vision" is to provide the highest and most critical science to address these issues.

ACE works to understand the problem and the intended uses (i.e., who needs the information and what decisions they are making). A balance exists between being innovative and forward-thinking but responsive to immediate demands. There is a strong relationship with EPA regional and program partners, and ACE has made a significant effort to translate its information for the programs, so that they can make the most use of the information. Some work is linear (e.g., developing a *Federal Register* notice) while other work is broader and requires a systems approach (e.g., water, climate).

Program offices are responsible for policy decisions while regional offices are in the field implementing many of these decisions and interfacing with the public. ORD wants to support policy and move ACE's work into regions. In shaping the ACE research agenda, input is taken from the Office of Air and Radiation (OAR), Office of Enforcement and Compliance Assurance (OECA), Office of Water (OW), Office of Solid Waste and Emergency Response (OSWER), Office of Chemical Safety and Pollution Prevention (OSCPP), regional offices, outside stakeholders, and the science community.

Dr. Costa listed four partner-stakeholder priorities: implementation sciences (e.g., new measurement technologies, air quality models and tools), emissions science (oil and gas priority, updating multiple inventories), public health and welfare (e.g., multipollutant issues), and climate change preparedness (e.g., assessments, adaptations, mitigations). The EPA Administrator identified implementation sciences as an area on which ACE should focus. In terms of overarching ACE research priorities, more thinking is needed regarding social, behavioral, and economic factors. ACE's three primary research objectives are assess impacts, prevent and reduce emissions, and prepare for and respond to changes in climate and air quality.

ACE's research program resources have declined. There were 380 full-time employees (FTEs) in 2007–2008, but the number has hovered around 300 for the past four years. There was a continued reduction in staffing and the budget decreased. By combining the three programs, they have reached $92 million, when ACE used to be at $98 million for one program.

There are currently 209 FTEs, including support staff, quality assurance, etc. and an additional 89 FTEs who are in headquarters (administrative). ACE is doing a lot given the number of staff. Regarding publications, ACE has many disciplines in various books and book chapters with the total numbers including their Science to Achieve Results (STAR) program. After discussing the meaning of impact factors, Dr. Costa explained how it is not necessarily a good metric. The Integrated Science Assessment (ISA) looks at all peer-reviewed literature, so something with wide impacts for ISA might not be in a top journal. Forty percent of citations were ORD funded or ORD led. ACE has received many awards including three Presidential Early Career for Scientists and Engineers (PECASE) awards and one MacArthur "Genius" Award through the STAR program.

The ACE program has been in existence since 2010 and has a strong reputation, which a link to climate only strengthened. Dr. Costa mentioned the StRAP, which covers much of the basic information from which this program evolved. He noted that ACE is a work in progress due to the restructuring, (re)emergence of climate as an EPA priority, and how energy elements are integrated. Challenges include working across program and regional offices (10) with slightly different needs and priorities. ACE has a matrix planning process, which involves a program- and lab-driven side to come up with the best approach. Working across labs and centers is difficult because each one is very different in the way they work with different philosophies. ACE is also developing a new way of thinking with a systems approach where scientists were taught to focus on one variable and one hypothesis. Further challenges included diminishing funds and PTEs.

ACE plans to take a fresh look at the program. Priorities include climate change, improving air quality, rapid development of air sensor and computing technologies, growing public interest in public health and translating the information. ACE will have discussions with partners to make sure their needs are met and they hope to continue to move forward to where they want to be in five years. ACE wants to have a vision of where they are going and how they are going to get there. Dr. Costa provided a diagram to explain how the program is envisioned. He stated that they are pushing to integrate across five topic areas, including science and social domains. Pertaining to the StRAP themes, ACE has tried to integrate their short-term objectives into their long-term objectives for each of the five goals.

When speaking about the proposed program structure, Dr. Costa mentioned that posters will be seen that are shaped historically in how they are doing them. Those projects are moving into the newer structure and they are having investigators rewrite their charters and how they will achieve their tasks.

BOSC could be a huge help to ACE. Part of what BOSC does is look back and they have done a good job (60/40 split). Dr. Costa explained they provide an objective perspective of ACE's "state of affairs" and also have a great perspective on program design and the quality of science. BOSC asks the questions: Are we doing good/right science? How should we move forward? Do you need more information on these things?

Dr. Costa concluded his presentation by explaining the materials provided. He stated that there are 170–180 ACE products per year and not everybody needs the information the same way (e.g., passive, active) and they want to maximize how they go about getting their information out. He closed by introducing Dr. Alan Vette (ACE deputy) and Dr. C. Andrew Miller, both with the U.S. EPA.

Discussion

Dr. Kinney stated that it seems like most of what has been seen in materials relate to internal staff research priorities and program areas, but in publications, a huge extramural area was seen. He then asked Dr. Costa to explain how the two are integrated in strategic planning in terms of research production. Dr. Costa replied by stating that they are not separated. The STAR program is highly integrated and among the six programs, their program is the best in that regard. Sherri Hunt is from the STAR (NCER) office who oversees the ACE portfolio. Everything done in the development of the RFAs is consistent with the program needs. Because of their fixed workforce, if they want to look to expertise they do not have or visions of where they should be in 3–4 years, STAR questions are formulated. There are ACE research centers that are integrated and involved (more than health-based research).

Dr. Kenski switched the topic to money and prioritization. She mentioned that in all of the material, it was clear what the priorities were. What was not clear was how many resources were going to each of these priorities. She was curious to whether they will ever see that and also stated that her priorities might be a little different. Dr. Costa said that is a question often asked. What complicates it in that situation is that the planning budget is about $27 million. The rest of it is in FTEs and infrastructure. Of that $27 million, about $17 million belongs to NCER. The

actual money that there is to implement across the program is around $10 million across air and climate (no energy budget). Most of ACE's resources rely in the people. With the matrix structure they have, there is a fair amount of operational activity still left with the labs. At one point, the labs had the money. The labs distribute their FTEs accordingly across the projects in consultation with HQ. Dr. Costa said it gets complicated because not all FTEs are equal, neither in expertise, experience, activity, or performance. He noted he liked to refer to the matrix as a cloud-based activity. They try to define what they are going to do and the products they will deliver to meet program objectives. With the small amount of resources they do have to play with, they try to use those very judiciously across the projects. It is further complicated by the fact that many years ago, NHEERL had an onsite contractor that the government wanted to save money and encouraged federal positions for the contractors as FTEs. Often, ACE's program partners say they want to see how much money is being spent in different areas, but that has no proportional relationship. ACE wants to make sure they get where they want to go. Dr. Vette stated that one of the things they are working on is to develop some pie charts to illustrate this. It is a bit unclear, but as Dr. Costa was pointing out, sometimes questions and requests arise from partners to better understand this. The value of FTEs is often overlooked, especially when looking at extramural research. Dr. Geffen commented that these questions were important for the impact of the science and how the programs run. When looking at the shifts in ACE, you still have FTEs. FTEs might not have the skillsets as you move forward. Dr. Geffen stated that she has some questions on how this process is handled, as it is very challenging.

Dr. Arnold asked of the $27 million, with $10 million remaining for the program, how this compared to other programs. Dr. Costa responded by stating at one time, air was the biggest program. The old human health program was combined with others to make the Sustainable Communities, which is believed to be the biggest currently. There were posters provided that demonstrate ACE's relationships with other programs. He noted it does not get back to the money issue, but the dynamic is different. Dr. Costa stated that he is proud of how well the STAR program is integrated ($8 million currently, but will be reduced some to $6 million). That is looked at as an integral part of the program. Dr. Arnold commented that the subcommittee understands this is complicated and they can navigate in the cloud. They would not make it all about money or people, but it would help tremendously to have these values.

Ms. Smith posed the next question in the discussion. She stated that this question is important for the subcommittee to understand, because ACE is focusing on a StRAP that goes from 2016–2019. She noted Dr. Costa had done a laudable job with aligning the research priorities with the Agency's priorities. Ms. Smith asked how he is affected when the priorities change. Dr. Costa stated that Agency priorities are fairly consistent over time, even though some get "warmer" than others and subpriorities arise (e.g., hydrofracking, PCBs in schools). There has not been much fracking activity because Congress has dictated as such. There has been a shift in climate, which would have been greater if Congress had a similar mentality and provided funding. He said Dr. Miller's relationship with USGCRP helps magnify contribution. He then noted things do come along that grab their attention and their money.

Dr. Werner stated that there is no specific energy budget and DOE spends a fortune on energy research. He asked what the interaction was with DOE and how ACE takes advantage of the research they do. Dr. Costa explained they are part of the Committee for the Environment and

Natural Resources and Sustainability (CENRS). Changes within DOE had not been a major factor in that activity. Pertaining to climate, investigations are happening currently. For example, on the "cook stove" side, ACE has a huge investment (e.g., STAR, labs), which is a mutual relationship. Dr. Miller also commented that DOE focuses on technology development and also on the energy system. They work with them closely in areas such as understanding evolution of the energy system from a broad perspective. Their focus is environmental endpoints. Dr. Miller stated that they have not done as much with DOE lately on the technology implications on the environment (e.g., waste products). Because NOx rules went into effect 10 years ago, the interactions on the technology development and deployment side have decreased. ACE has some growing areas (e.g., climate and water, climate and energy) and understanding what is on the next horizon (e.g., how fracking was). They are not doing a lot that would show up as an official level of interaction, but there is a lot of familiarity and staff-level interactions. There is a lot of common ground and they take advantage of that.

Concluding the questions, Dr. Zhao asked to know the breakdown of the money that goes to internal research versus what goes to external research (e.g., STAR program). Dr. Costa stated that $17 million of the $92 million goes to extramural research. Sherri Hunt noted they can provide numbers if needed. The priorities for the STAR grants vary from year to year. They might invest a large amount of resources in one project that goes on for a few years. They are buying time with that money, which is combined into the STAR grant.

Program Purpose and Design (Questions 1 and 2)
Dr. Dan Costa

Charge Questions 1 and 2 are provided below.

1. Given the research objectives articulated in the StRAP, are the topics and project areas planned and organized appropriately to make good progress on these objectives in the 2016-2019 time frame?
2. How effective are the approaches for involving the EPA partners in the problem formulation stage of research planning?

Discussion

Dr. Kinney began the discussion by requesting clarification on topics and project areas. Dr. Costa settled this confusion and clarified that is what they were asking about.

Dr. Zhao stated that the topics and project areas were very broad. He asked where things like fracking and renewable energies fit within these. Dr. Costa noted they had done fracking on the water side but not on the air side. The initiative was there, but the funding was not. Dr. Miller explained there are three main topics within energy: looking at energy as a whole using the MARCAL energy model (SEM-1), specific technologies (SEM-2), and end-use impacts (SEM-3). When focusing on specific technologies, things are structured specifically to address issues like emissions and other air-related issues of fracking and similar extraction activities. The structure is there, but they have not been able to take advantage of it due to lack of resources. Something like renewables are not within their scope, but they do try to take them into account

unless there is an environmental impact. He stated that they are not concerned with energy system dynamics. Dr. Zhao commented he was thinking more about the environmental impacts. It affects air quality and health impacts. Dr. Miller clarified this comes into play in topic 2 (MARCAL). At a regional basis, they look into how they allocate that information down to look at air emissions from specific locations.

Ms. Smith continued the discussion asking about accessing the ACE Intranet website. She also asked if it will be useful for them. Dr. Costa stated that they will not have access to EPA's Intranet. He mentioned they could provide a demonstration, but it would not help as an information resource. This information was part of the hard copy materials given out. Dr. Geffen commented that as they figure out what information they need, it could be addressed at a later time.

Dr. Aneja mentioned there are air issues associated with fracking. EPA has invested in water issues, but not in air issues. In essence, they are ahead of the curve. He asked Dr. Costa how they address that dilemma. Dr. Costa explained that the Environmental Defense Fund (EDF), for example, has been investing considerably on air issues. EDF, HEI (Health Effects Institute; public-private partnership established in 1980), etc. have been working to come up with a research plan. They recently initiated some work with these groups interested in air impacts of fracking. Congress has not wanted EPA to do air research associated with fracking. They gave money for water research approximately seven years ago and the report was issued two weeks prior to the meeting. DOE is performing a lot of work with measurements. ACE's role would be to connect the health implications. Dr. Miller noted it is not just EPA. EPA, DOE, and USGS development multiagency strategies to look at environmental effects of unconventional oil and gas production. Historically, they have relied on the private sector and environmental organizations to do a lot of research. They are connected and aware of the EDF work. They are trying to leverage the interest and resource groups like this have in collecting environmental data. Dr. Miller stated that in some ways, they would like to be at the forefront, but they take advantage of resources where they can. Dr. Aneja continued by stating his intent with the question is the industry versus the regulatory body that has to make the decisions. Dr. Miller explained they do not have much authority there. Dr. Costa noted they try to vet that information so they can base decisions on it when appropriate. Dr. Arnold commented that there is a long history of incorporating industry-led research. It is important to remember almost everything done now involves fracking. There is a way to fit it in without creating a separate program. It can go on without its own separate headline. Many activities may happen under other projects. Dr. Miller mentioned Congress has not said that you cannot do it; they are just not providing funding. Dr. Arnold replied with reminding Dr. Miller that they do have money for emissions monitoring. He asked if they could do special projects under existing umbrellas without drawing attention. Dr. Vette explained that the oil and gas extraction and emissions associated is not addressing fracking directly, but it involves it. One of the recent undertakings is the coordination activities to better define and reduce uncertainties with oil and gas emissions (e.g., HAPs, VOCs). Dr. Arnold continued by saying there might be activities going on to address headlines that are not obvious and will take interaction between EPA and the subcommittee.

Dr. Zhao asked how much opportunity there was for interagency collaboration. Plans are often put together but not acted upon. Other areas (e.g., mobile source side, work closely with DOT,

contributed money) were the stimulus for work starting in 2006. They were sued by Sierra Club for expanding a highway in the Las Vegas area. They did not have the research capability to deal with that. Dr. Miller stated that there are a lot of interactions, but they are not always formal (e.g., dollar amounts, resources). In terms of ability to work across agencies, we strive towards natural interactions with PIs who have similar interests. Dr. Miller explained they work with the National Oceanic and Atmospheric Administration (NOAA), U.S. Army Corps of Engineers (ACOE), National Aeronautics and Space Administration (NASA), Department of Energy (DOE), Fish and Wildlife Service (FWS), etc. and there is no restriction on that kind of interaction. When resources are being exchanged, formal agreements must be put in place and transactional costs increase. There are incentives in place to not have to make formal arrangements. They are not needed in most cases. Many of those interactions do not have much visibility, but Dr. Miller does not think there are too many PIs across organizations that are not aware of other activity and leveraging. Sherri Hunt mentioned they did not coordinate for large effort. It was a matter of coordination, timing, and someone to do that work. It was a massive amount of work to get funding coordinated with other agencies to do STAR-grant collaboration. Sherri stated that they all want to collaborate more, but it is having the person to make that happen that proves difficult. Dr. Vette noted they have MOUs/MOAs with other federal agencies. In some cases, they are broad; in other cases, they are very specific. For instance, they have had a growing collaboration with NASA and the MOU is up for renewal. Working closely with NASA, EPA is striving to better define objectives and lay out specific activities they are involved in. Dr. Werner commented that things like the Clean Air Act (CAA) Amendments in the 1990s worked very well and were very formally established.

Ms. Smith stated that she was interested in hearing about public-private partnerships (PPPs) and cross-Agency coordination. Concerning Charge Question 2, she asked if the partners are just internal. This answer was yes. She then asked if they needed to know anything about PPPs to deliberate on Charge Question 1. Dr. Costa said he does not think so. The primary public-private partnership they work on is AGI. They establish a joint presentation to present to OAQPS and OTAQ with EPA's priorities and what they would like to see AGI do. He said when diesel was classified as a Class 1 carcinogen by IARC, EPA and AGI worked together. Dr. Arnold mentioned they might not need this information for Charge Question 1, but it would be helpful for Charge Questions 4 and 5 because so much work is done with external partners (e.g., HEI, STAR). He explained this might help them to evaluate questions to have some more background. He referred to Dr. Miller saying collaborations were ad hoc, but it puts a lot of pressure on individual PIs to work within a budget matrix and FTE matrix. He stated that he is not calling for additional MOUs, as that would be a logistical nightmare, but suggested they should look at how they can support PIs to make those collaborations happen. It would be useful if the subcommittee had a better way to look at that. Dr. Costa said before, labs had all funding which drove research. He continued by saying it was comforting to know that folks at the staff-level are making an effort to understand what the problems and issues are. Not to say some research is personal interest, but overwhelmingly, people have had vision. What has changed is that the interaction with their partners has become more formalized with their internal partners, including STAR. Dr. Costa said research that they are doing has to address the primary questions in the program office. Everyone agreed that it is a good idea to maximize diminishing resources, defend activities, etc. That was a big change. He mentioned the downside is people begin to feel more constrained and a little less risk-taking. He thought we should make mistakes. A lot of science

comes not from "aha" moments but from "hmm, that is interesting" moments. They have an innovation team. He stated that it is an evolving process. Dr. Arnold commented they have to invest in the possibility of failure. They have to be able to absorb those failures when they are looking to the future.

Dr. Senior related her question to Charge Question 2. She continued by saying when research is done, there is lots of QA and peer review. There are also shorter-term needs for people who need technical information to respond to comments. She asked how they manage short-term interactions and balance it with longer-term research. Dr. Miller responded by saying they have tried to quantify that, but it is not easy. It could be a quick phone call. In some cases, it is informal. Generally, there are internal working groups for regulatory actions for other processes that ORD staff are involved with. There is usually a negotiation between the staff member and management, but it does not show up in their strategy. They try to understand the load on staff members, but they do not do a good job of quantifying it. Some PIs are more willing to be involved than others (personality, expertise). It is not well recognized when they are discussing their program that it is expected for ORD to participate in this way. Dr. Miller stated that it is more of an overhead issue. It is a critical issue and relies on them having done the right research. Dr. Costa noted there is certainly technical support. Sometimes there is more than that. For example, when OAQPS was coming up with a MACT standard for controls, one of the NRML investigators realized the methodology was missing. They worked with the investigator, gave him supplemental funding to work closely with industry, OAQPS tested, and CEMs were developed. Dr. Costa mentioned the method had to be developed quickly.

Dr. Werner stated that for years, the air lab at EPA developed control technologies and said none of the projects seem to be doing that. He asked if that was off the table. Dr. Vette responded by saying that area is not off the table, but it is not an area where they are invested and is not a partner priority. Dr. Miller contributed by stating that the technologies already out there do a good job. This is not the case for carbon dioxide, but that is DOE's job. Dr. Miller noted they try to understand the environmental consequences, but they are at a place where control technology development is not an active effort for them.

Dr. Kenski switched the discussion to innovation and freedom to fail. She had seen a large emphasis on translating research into solutions. She was surprised to hear ACE has PIP. Dr. Kenski asked where the innovation was in the materials provided. Dr. Costa said there is a small group with funding across the programs. For example, they used satellite technology to look at coastal erosion and nitrogen runoff. He states like most innovation things, if 1 out of 10 is hit, you are probably batting pretty well. That is not part of the ACE program. They are involved in the selection as to whether it will fit into their program 4–5 years down the road. They encourage people to think out of the box and try to reward them for doing so.

Dr. Kinney mentioned historically, EPA has done a ton of work on the air side of climate. AQ has improved tremendously in part because of science. Climate is a relatively new area. He referred to the endangerment finding that lead to EPA taking on climate and how health effects were a big part of it. He knows ACE is in a period of transition, but Dr. Kinney asked if they see direct effects of climate on health as a growing area of research. Dr. Costa replied that this is a cross-Agency issue. They have used the STAR program to get at this. Climate has many indirect

implications, e.g., ozone, particulate matter (PM). Dr. Miller contributed by stating lots of things (allergens, etc.) expect to be affected. It is one of those things that does not always show up as climate (e.g., algal blooms).

Dr. Zhao asked to what extent the comparative advantage of EPA factored into this. There are other research groups addressing societal needs. He did not see any discussion of advantage. For example, EPA is at the forefront of policymaking. There are policy needs that need quick research. He mentioned he saw some synthesizing work, but not a lot. Dr. Zhao asked what the role of synthesizing was related to social influences and policy needs. Dr. Costa completely agreed with Dr. Zhao. For the past 3 years at least, SAB has pointed out to ACE that they need to look at socioeconomic impacts. They have a fixed and diminishing FTE base, which makes it difficult. A lot of ACE's work resides in the Sustainable and Healthy Communities group. There is no well-structured leadership team. Dr. Costa states they have not provided a lot of programmatic support to provide the public with tools to protect themselves. Dr. Miller commented that he heard part of Dr. Zhao's question was on synthesis. ACE has been really pushing for more syntheses of the work they are doing and incorporating what is being done externally. Part of the challenge they have is that a lot of the expertise that they have is focused down and down and down. Dr. Miller stated that they hear more and more often and more and more clearly from their partners (particularly regions), they want simple and clear summaries of what the science says that they communicate to the public and at the local level. From Dr. Miller's perspective on the climate side, they get asked about the best science and the best tools. This is an issue across the science community: how they synthesize and condense that information so that it can be used. ACE is aware of that and is trying to move in that direction, but it is not a matter of just writing it down and it will be done. It is requiring much effort, but they are trying to put that effort in. Dr. Costa commented that one of their RFAs in the STAR program is on coarse PM. They want a synthesis paper done that brings that data together. Another example is near-road. Dr. Miller added that water quality climate assessment is being done in partnership with OW. They are learning as they go.

Dr. Mitchell explained there was some confusion as to what the science community does. He suggested that there are some opportunities (e.g., Village Green) to look at the data and think about what questions can be answered, what questions cannot, and what information is missing. This is an opportunity to get people thinking that science is a process that goes forward and allows people to make decisions, not just a collection of best facts. Dr. Mitchell stated that he has a colleague that has a site called squirrel mapper. It allows people to plot data across the world and look at population genetics. He states he needs a better understanding across the public of what science does and what science does not do. It is an important step. Dr. Costa said Village Green data is being posted on the AQI site. The ACE program is trying to make an effort to educate schoolchildren (e.g., training next door, climate games, climate contests) and reach out on these sorts of education things. Dr. Vette added they are working with a community in Region 2 to use air pollution sensors to better understand air pollution in their community. They are scheduling a training a month after the meeting to design studies. Where they have expertise, they are trying to get that information out there. Dr. Mitchell asked if part of the training about precision and accuracy. Dr. Vette replied yes, and that some sensors are better than others and the issue of uncertainty is a very important piece of information. Dr. Vette stated that it is not always a bright line. There is some interpretation to science and the more the public understands

about that, the better informed they are going to be. If they can communicate the terms similar to how they report the weather (i.e., there is a 50% chance of rain), this would be better.

Program Effectiveness and Quality (Questions 3, 4, and 5)
Dr. Dan Costa

Charge Questions 3, 4, and 5 are provided below.

3. How well does the program respond to the needs of EPA partners (program office and regional)?
4. Please comment on the quality of the products delivered by the program. Are there additional approaches that could be taken by the program to ensure that its products are of high quality?
5. How well have we translated research findings and understanding for the end-users? How can we improve our ability to translate research findings and understanding for end-users in the future?

Discussion

Dr. Werner stated that the program offices also fund research projects. He asked how those get coordinated with ORD and how they ensure those meet quality standards that ORD has. Dr. Costa replied that the program offices fund some, but have had funding cuts on their end as well. That is another work in progress. When the programs conduct research (e.g., methods development), ORD is sometimes consulted. Other times, they go out and get what they need. Dr. Costa stated that he believes it is an effort that is improving. Dr. Vette said the nature of the research the program offices and regions would support is different from what research program and regional offices are doing. He noted it is not as if they are duplicating effort. There may be some very specific short-term needs that program or regional offices want done that they need to get done quickly. Dr. Miller continued with regards to quality, the program offices are very aware of data quality requirements. For the most part, rules undergo a lot more scrutiny than a journal article. They often go beyond what ORD does. Ms. Smith commented by saying Dr. Werner called out specifically under Charge Question 4 measurement indices. She stated that she would ask the subcommittee members to look at the charge questions with that in mind. Dr. Costa mentioned that would be something to think about during the poster session.

Dr. Zhao stated that there are two issues; one is tracking the metric and the other is the reward system. One example he gave was a research group within World Bank. They are rewarded for publications and evidence of their report being used by field offices. Another example given was at universities. They all have an outreach component. Because this is a reward, they keep track of that. Dr. Zhao asked if there was a way to have EPA researchers tracking this and simple surveys to regional offices tracking instances of using the reports. Dr. Costa stated that they have tried some of that (e.g., charters) and they have done surveys for program offices before. Some staff were happy because they got what they needed and other folks were not happy. It does not always give a representative reflection. When positive feedback is given, it is very valuable. Dr. Costa was not sure how they would do the award system, but it is worth considering. Dr. Vette noted PIs get “rewarded” by promotion through the Technical Qualifications Board (TQP),

which is similar to the tenure package. They have to demonstrate what impact their research has had on the Agency. There is an advocate for the individual who can speak to the impact and value of the work. The EPA has been trying to introduce that more in a formal regard. They have increasingly placed emphasis on a team-based approach. Following Dr. Vette's statement, Dr. Zhao commented that the point of the quantitative measurement is to develop a trend over time. Dr. Costa concluded this question stating stakeholders, clients, etc. are a lot happier with the type of work they are doing now than what they were doing before.

Dr. Arnold asked (as part of Charge Question 4) whether there are other approaches. He stated that ACE has mentioned how they have taken disinvestment in control technologies. He was interested in how they make decisions about disinvestment. Is it budget-driven? 80%? More or less? Dr. Miller said it is a combination. If budget is going down and partner interest is also going down, it is a clear indicator to move out of that area. ACE also continued investment when interest and budget went down, because they believe it is important for the future. They have to pay attention to Agency needs. Dr. Arnold continued by saying he thinks there is a potential danger in as ACE becomes more relevant and able to deliver short-term products, there will be more disinvestment in arguing for the second thing Dr. Miller has mentioned. The only thing that makes happy people unhappy is taking away something that they have come to rely on. Dr. Costa mentioned NHEERL was very strong on methods and emissions. Then, they shifted to source-apportionment. Then the older members retire and are replaced with younger employees. ACE then gets hammered on methods development. Then, they move onto toxicology in the 21st century, which is where funding is focused and methods fall by the wayside. ACE is disinvesting in the toxicology side. It is a game and some of the flows take a decade to get back to where you want. It is a difficult activity to balance the new things and some of the other things that have to be done. Dr. Costa said they receive input from the program offices, SAB, etc. It is a balance and the future is difficult to predict. Dr. Lindsay Stanek commented that one example that may need discussing is biofuels. Dr. Costa noted biofuels was the genesis of their energy program at one time. Their biofuels budget is $0 and has been for the past 3 years.

Dr. Mitchell stated that Charge Question 5 was interesting. Transferring the knowledge is one part. The end-user could be a large and diverse group. He asked where EPA sees its biggest impediments to providing information for decisions to be made for research to go forward. He also asked what the most important step was to go through to make that happen. What people need to be informed? Dr. Mitchell noted he is aware of EPA's restrictions to go directly to Congress, but was curious as to how they see themselves putting out this information to maintain the high quality of the program. Dr. Costa answered by saying in the past (academic version of ORD), people would publish papers and the program office would not know it until they came across it in a search. OAQPS, ORD's primary client, is right in their office. ORD has a formal time where they pull together primary products and get some feedback from OAQPS on how they will be used. It goes through the management team and back through ORD and they say ORD is doing a good job. Budgets depend on OMB and Congress to an extent. A lot of it is built on communications and confidence and they know they can come to ORD and get what they want, both in the long- and short-term. He noted putting it on the internet is not effective. Dr. Miller commented that he thinks of the PIs as the factory-floor worker that is making what ORD produces. ORD is asking them to be marketing, sales, production, etc. It takes a lot of time to reach out to their partners and that takes away from the research they can do. Dr. Miller said they

would not be true to the facts if they said communication does not come without a cost. A comment from Dr. Kenski followed stating ORD mentioned a number of citations and those types of measures. She wanted to caution Dr. Costa that sometimes you can have a small audience for a particular project or paper (e.g., emission speciation, emission modeling). That data feeds into air quality models at the state-level to make control decisions that have implications in the billions of dollars. The value of that data cannot be judged based on how many people look at that paper. She noted she is seeing disinvestments. Dr. Costa stated he could not agree more. He said they are now investing more in that. They have a lot of work that does not grab headlines that is extremely important. They are trying to work more with states, which seem to want methods development for measuring things. There is no one index that seems to be useful for everything. Dr. Vette mentioned it is a challenge to quantify it. It is not as much of a challenge to document it. He hopes the subcommittee can make some recommendations on how to quantify it or share sentiments on this topic. Dr. Costa concluded the discussion by saying work that comes out of the STAR program is often picked up immediately. If somebody says they are off by a factor of 92 on chromium, there is not the same news attention.

Program and Regional Office Perspectives

Mary Reiley, Office of Water (OW)

Ms. Reiley discussed how EPA OW looks at the ACE program and how they collaborate. She stated the Office of Water has come a long way in the last two rounds of StRAPs. They saw bits and pieces incorporated into the ACE StRAP. Over the past 4 years, OW has participated more and are pleased with how water issues have been picked up in the latest StRAP. They have taken a systems perspective and there is a push toward integration and systematic processes and how they can bring those pieces together. There is also an emphasis on the air-water interface. Ms. Reiley noted the air component of non-point sources has been a black box. By having these models in place, OW can provide a more quantitative accounting of air deposition to water bodies when they are doing TMDLs. They can approach the problem from all different directions. ACE has also been working on sensors. Water is a more challenging media to use sensors in, as they take a beating and have a short lifespan. OW is hoping they can use what ACE has learned about using sensor technologies, as states want faster, more real-time understanding of what is happening in their waterways and impacts wastewater discharge has on non-point sources. One of the big questions for the water program is what impact energy will have on water. She said they want to make sure we are maintaining adequate quantities of adequate water. Dr. Aneja opened the floor to discussion.

Discussion

Dr. Senior noted that Ms. Reiley said that she had a person who is specifically directed to communicate with ACE about their programs. Dr. Senior asked the main mechanism by which OW interacts with ACE. She continued by asked if there are other mechanisms OW uses to work with ACE and how effective they are. Ms. Reiley replied by saying they have one avenue. OW also participates in a variety of webinars that ACE hosts and consults the information ACE puts into the Research Management System (RMS). The communication goes in both directions. Their National Water Program Strategy updates are done on a 4-year basis. The action plans and

research questions are ones that OW has been putting forward to all of ORD's research programs so they are aware of OW's needs as they go into the StRAP process. There are also newsletters, lists of upcoming publications, annual product review, and AA to AA discussion.

Dr. Geffen asked if Ms. Reiley could expand on how the priority setting process goes, given the breadth of the ACE program and what her perception is. She stated she is sure there are many things OW would like to see but ACE has many stakeholders to whom they have to respond. Ms. Reiley responded that in the last round, she has not had a concern with priority setting. She feels OW is well-heard and they have picked projects that enable them to bring together air and water aspects of the problem they try to solve. OW has not been in a position to pick one over the other. They are organized by the mission they are trying to achieve—complimentary to each other, not competitive.

Patti Tyler, Region 8

Patti Tyler is the Science Advisor for EPA's regional office in Denver, Colorado. EPA's Region 8 encompasses Colorado, Utah, the Dakotas, Wyoming, and Montana, and works with 27 federally recognized Indian tribes. She stated that the air quality across her region is rapidly changing as a result of both conventional and unconventional air and gas activities.

As the Science Advisor for the region, one of Ms. Tyler's main duties is to serve as the science liaison between EPA Region 8 and ORD. There is a Regional Science Liaison to ORD in each of EPA's 10 regional offices. In addition, there is a Superfund and Technology Liaison in each of the 10 regions.

Ms. Tyler said she has enjoyed this position for almost 15 years and has seen a dramatic improvement with ORD's engagement, involvement, coordination and communication with the regions with respect to research planning during that time, especially over the last 4-5 years, since ORD has transitioned to six major research programs.

She said that the Regional Science Program decided to invest more of an emphasis with the regional interaction with research planning about 4 years ago, and the Regional Science Liaisons support their lead region for that particular media for that two year cycle. For example, EPA Region 8 is the lead region for air. Therefore, Ms. Tyler is facilitating the interaction between the regions, ORD's ACE research team and OAR. I communicate with the others RSLs and Region 8's Lead Region Coordinator, and we share information with the regional Air Division Directors and Air Program Managers.

Ms. Tyler said that, in addition to the RSLs supporting ORD's research efforts, they manage the Regional Applied Research Effort (RARE) and Regional Research Partnership programs. RARE provides the opportunity for ORD and regional scientists to collaborate on near term high priority region specific or multi-regional research. The RARE program has been in existence for almost 26 years and is funded at 2.6M/year. The Regional Research Program provides regional scientists the opportunity to participate in a short-term training detail at one of ORD's labs or centers. Both these programs are funded by ORD and critically important to the regions and the professional development of our regional staff.

Ms. Tyler said that currently there are 13 regional research activities that fall within the ACE portfolio:

- six of the regions involved with field evaluation of low cost sensors
- Region 2 citizen science toolbox
- Regions 3, 5, 6, and 8 passive sampling for VOCs
- sources and deposition of ammonia in RMNP
- identification of safe dust control for Alaska Native Villages
- passive and active sampling of PCBs in indoor environments
- climate change impacts on coastal drinking water supplies
- emission measurements from oil and gas activities and integrating those updated measurements into air quality models

For example, over the last 6 years, Region 8 has completed four regional research projects and hosted three ORD funded Fellows that have focused on air quality measurements used for emission inventories, emission factor generation and ozone modeling applications. The critical value and reliance on ORD collaboration to tackle both source and ambient oil and natural gas emission characterization techniques through measurement and modeling techniques should be notably highlighted.

Ms. Tyler said she has been interacting with the ACE team since last October and has enjoyed a valuable relationship with the entire team. She applauded Dr. Costa for bringing Beth Hassett-Sipple on as a Science Associate and said her focus on Regional and Program Office communications and coordination is outstanding.

Ms. Tyler identified the following research mechanisms and activities as being of high value to the regions:

- ORD's RARE and RRPP programs, which she strongly encouraged evaluating ways to expand that program into a more permanent presence within the ACE portfolio and for ACE to evaluate those efforts; however, RARE does not include travel funds for regional or ORD scientists
- biweekly ACE connections calls, especially the recent addition of Moment of Science presentations from the regional and program office partners (this in the packet of information distributed to the subcommittee members)
- Quarterly ACE research news, which could be enhanced to include more regional and program office projects and highlights
- the recent updates to the internal and external websites, which she strongly encouraged adding the bulletin board to provide another mechanism for regional and program office partners to collaborate, and maybe start as a pilot
- this year's research planning meeting that provided an opportunity for regional partners to share their research efforts and the opportunity for them to attend the meeting, and she thanked ACE for funding the regional travel, as regions travel budgets are pretty limited
- Regions' participation in the Science to Achieve Results (STAR) programmatic review of proposals; the regional reviewers are in the position to inform the potential relevance of a proposed research project, and it would be important for ORD to consider funding the

travel of these regional reviewers to the review meeting, as they are at a real disadvantage participating via the phone
- I also believe that the follow-up five ACE research topic webinars will be of great value to the regions.
- The regions are also very interested with ORD's efforts in training regional community action groups with respect to Air Monitoring training this July.
- Summer 2014 DISCOVER-AQ efforts
- technical assistance
- research synthesis and translation, the regions metrics of research success is not based on the # of ORD publications

Ms. Tyler said that during the ACE Jamboree, several recommendations were made with respect to the evolving relationship with the regions, program offices, and ORD:
- Continue to explore opportunities to initiate or strengthen connections between the Agency's partners during the life cycle of a project, from problem formulation to research translation taking into account a more active delivery of the research product. The commitment from the partners needs to be feedback on the research and the impact it made. It remains a real challenge getting regional staff involved in research planning due to their core workload, lack of travel funds, and inconsistent management support. It might be interesting to investigate the use of the Skillports Marketplace.
- Evaluate and create a timeframe for responding to the partner comments made during the Jamboree to increase the transparency and trust.
- Consider holding some of the ACE workshops, training, and scientist to scientist meetings in the regions. For example, Region 8 is very interested in pursuing additional opportunities with ORD in collaboration with other federal agencies like NOAA, NASA, NCAR, and federal land management agencies with respect to emissions measurements and atmospheric modeling. Region 8 would like to coordinate with Regions 9 and 10 and have more of an in depth discussion on regional haze, background zone, and oil and natural gas emissions measurements.

Discussion

Dr. Zhao stated that Region 8 hears lots of calls from local communities about research needed. He asked what channel is used to convey this to ORD. Ms. Tyler replied by saying they track those calls and record the inquiries. Once they come in, there is an assessment as to whether it should be addressed at the regional or national level. Dr. Zhao continued by giving an example. Suppose one of the research groups at ACE developed a nice monitoring system that RARE wanted to promote to local schools in Colorado. He asked if they have to go to the regional offices. Dr. Costa noted ACE does not have to, but certainly would. Ms. Tyler supported this statement by explaining they have an informal approach within the Agency in having the regional science liaison. ORD reaches out through this mechanism to make these connections.

Dr. Arnold noted ACE has to connect incentives to metrics. He asked if incentives operate at the implementation phase versus within ACE. Ms. Tyler replied that not having travel funding availability is difficult. For a particular individual, they have been able to do a lot. If they do not have management, it makes it difficult for them to get involved. Region 8 has awards that are

provided to ORD scientists for work they are doing within the region. She does not think they have enough of those mechanisms.

Dr. Werner asked what involvement RARE has with community programs and how do they collaborate. Ms. Tyler said when they put out proposals, they can involve other federal, state, and tribal groups. The opportunity is there and they have funded past projects with this.

Ben D'Angelo, Office of Atmospheric Programs (OAP)

Ben D'Angelo stated he is responsible for climate policy development, analyses, and communications. Examples included:

- Greenhouse gas (GHG) endangerment finding under CAA, 2009
- Proposed endangerment finding for aviation
- Economic analyses to support domestic policy/international negotiations
- Greenhouse Gas Reporting Program (GHGRP)
- Domestic/international voluntary programs

Among all ORD research programs, ACE was core to OAP for climate research and they were the most germane to OAP needs. OAP very much appreciated ORD's increased focus on nexus of climate change and human health research and continuation of fundamental research (e.g., quantifying/understanding role of black carbon in climate change). OAP relies heavily on major scientific climate change assessments to inform policy/rulemaking under CAA and communications (e.g., impacts of climate change on air quality assessment). Climate change impacts on water quality have also been very useful to OAP. Pertaining to the Jamboree and ORD considering greater emphasis on outreach/communication to broader audience, including communities, decision-support tools for communities, OAP will continue to work with ORD to understand the community based work that can complement OAP's work. OAP makes the research more accessible to program offices – a lot of regular calls, online project database – inclusion of OAP in the STAR grant process is beginning to shape solicitation in first place. Ben D'Angelo mentioned STAR grants have been a great tool.

No questions followed this presentation.

Rich Cook, Office of Transportation and Air Quality (OTAQ)

Dr. Cook said that OTAQ is the program office within Office of Air and Radiation (OAR) responsible for regulating pollution from motor vehicles, engines, and fuels and encouraging travel choices that minimize emissions. In order to develop regulatory and voluntary emission reduction programs, OTAQ has a large laboratory which tests and measures emissions, develops test procedures, and conducts advanced technology research and evaluation. OTAQ also develops models for estimating emissions from vehicles, engines and fuels. ACE research is critical to OTAQ's mission. Key research areas include:

- Near-road air quality and health effects – ORD's groundbreaking research has greatly improved OTAQ's understanding of this important public health issue. This has led to a national monitoring network and guidance and outreach materials, and supported major rules such as Tier 3. It has helped identify other research needs, including brake and tire

wear impacts, ultra-fine PM emissions, exposures and health effects, and impacts from port and rail. OTAQ is looking to ORD to continue research on models to characterize near road impacts and develop mitigation strategies as well.

- Photochemical modeling – ORD's CMAQ research program is mission-critical to OTAQ. Improvements in SOA chemistry have helped OTAQ address comments about renewable fuel impacts and research in that area should continue.

Dr. Cook said that, overall, OTAQ has effective coordination with the ACE program through the following:

- ACE planning process
- Periodic senior management meetings
- Two scientists with joint OTAQ-ORD appointments
- Regular meetings and collaboration on emissions research between OTAQ and ORD scientists and engineers
- Periodic meetings between OTAQ and ORD air quality modeling researchers to ensure emissions and air quality models are integrated and can address key policy questions.
- Work with NCER on writing RFAs and participate in relevancy reviews.
- Organization of joint meetings and workshops (e.g., recent ultrafine PM Workshop and Transportation Research workshop organized with NCER in Ann Arbor).

Dr. Cook said that in order to avoid mission overlap and potential duplication of effort, continued close coordination with ACE is needed. Key areas included biofuels, life cycle, and energy systems modeling, emissions, and air quality modeling. Increased focus on "citizen science" in ORD increases potential for mission overlap. He said that OTAQ is concerned that work on citizen science and sensor technology research could necessitate a resource shift from other critical work, especially given the diminishing resources in ORD. Program office input on prioritization of work and resource allocation is needed.

Discussion

Ms. Smith said she was interested to hear Dr. Cook talk about his appreciation for the ORD research in near-road emissions. Ms. Smith was interested in hearing his thoughts on the dynamic between ORD and his program and how the idea that near-road emissions research was a real need to begin with. Dr. Cook replied by saying 7–8 years ago, this issue started getting raised more frequently by OTAQ's stakeholders. Ms. Smith commented what she heard is the idea for the research came from your stakeholders. Dr. Cook said yes, ORD was doing work in that area.

Richard (Chet) Wayland, Office of Air Quality Planning and Standards (OAQPS)

Mr. Wayland introduced himself as the Division Director for the Air Quality Assessment Division (AQAD) in EPA OAQPS within OAR. He explained that OAQPS is responsible for developing the national air quality standards for the criteria pollutants—ozone, particulate matter, sulfur dioxide, nitrogen dioxide, lead, and carbon monoxide), as well as setting the national air toxics regulations for stationary sources. His division is a technical division that has the responsibility for managing the national ambient air quality monitoring network, providing

national guidance and direction on air quality modeling, developing the national emissions inventory and analyzing national air quality data as well as developing source monitoring methods for use in stationary source compliance. All of the technical work AQAD does either supports the setting of the criteria and air toxics standards or is specifically designed to help implement/comply with those standards.

Mr. Wayland said that because of the highly technical nature of its work, AQAD depends on ORD a great deal as a resource to provide the most credible scientific and technical models, monitoring methods, and emission factors. He said that they depend on that peer reviewed research when challenged in the court of law over our regulations and to date, they have never lost a legal challenge based on their science or technical work. Policy arguments are a different issue. He said it is imperative for the program office to have the ORD backing on the science and critical that AQAD is continually striving to put the best science forward in their program decisions and tools.

Mr. Wayland commented that while AQAD has always enjoyed a close relationship with ORD both physically (i.e., co-located in the same buildings for years) and professionally, the onset of the ACE program has greatly enhanced the inter-office communication. She said that AQAD is fortunate to share the physical closeness as it allows our staff teams to work together more effectively on many issues, and it allows our managers to interact frequently. In addition, he said that he thought the ACE program has been responsive and relevant to the priorities of the program office when we have raised such priorities.

Mr. Wayland said that as they have continued to improve air quality in this country and have subsequently tightened air quality standards based on new science around health effects, they are also continuing to challenge their monitoring methods, their air quality models and emission inventories to be more precise and to reflect that changing atmosphere that has resulted from over 40 years of emissions reductions.

In that light, Mr. Wayland said that he thinks they need to continue to strive to get core research in the areas of improving emission factors, improving ambient and source monitoring methods, and improving our understanding of atmospheric chemistry to better develop our air quality models. They also have to continue to look at the climate and regional air quality interactions as they now understand better the implications of a changing climate on air quality.

Mr. Wayland said that while focusing on these core research areas, we also need to understand the changing technologies that are developing and the ability for scientific measurements to be recorded by non-scientists through sensor technologies and what does that mean for EPA and how we manage the nation's air quality programs. With more and more individuals becoming empowered by technology to measure air quality, he asked the role they play in the science behind that technology and for the program offices and regions, in the implementation of that technology. With less and less money available for state and local agencies to do sophisticated monitoring, how do we leverage this new technology as well as information from satellites to supplement current capabilities.

Mr. Wayland stated that continued research on improving our understanding of air toxics through better measurement technologies, better emissions characterization, and better chemical mechanism development for the models is fundamental to the program office having a stronger and more beneficial air toxics program.

Mr. Wayland said that the ACE program has done a nice job of trying to address program office priorities and believed there is a significant challenge going forward to balance moving forward with new innovative technologies and broader initiatives like community outreach and at the same time, doing core research to update and improve the tried and true methods and technologies. With limited resources, the challenge becomes how does one keep a foot in both areas without sacrificing one area for the other. He said he thinks it's through the continued communication between the program offices and ORD and the willingness to be vigilant in revisiting of priorities that such a balance can be achieved. Figuring out where the program offices and the regional offices can assist in implementation aspects and maybe share some of that burden with ORD may be useful to trying to get everything done we all desire.

Mr. Wayland said that, in the end, they could all agree that more resources and FTE for critical air quality research would be ideal, and they recognize that we do not have that luxury and so, the organization moves forward doing the best they can. The process ACE has set up provides the opportunity for that dialogue, and it is up to all of us to continue to have the direct and useful communications on research priorities.

Discussion

Ms. Smith noted that Mr. Wayland ended his remarks with the balance between short-term needs and long-term research. She asked how short-term needs come to his attention. Mr. Wayland responded that OAQPS has weekly and monthly interactions with ACE. They talk about research priorities every year (e.g., Jamboree). Occasionally, things pop up with the annual cycles, but they try to stay flexible. Communication is the key. He noted that on the program side, OAQPS has to be sensitive that everything cannot move on a dime. From the research side, sometimes priorities are short-term and it is important to be adaptable.

Dr. Aneja began by mentioning satellites. He asked how he sees himself moving forward to use that technology and be defensible in court. Mr. Wayland replied by saying when you compare carbon dioxide measurements, they match up pretty well but there are places with large discrepancies with OAQPS's emissions inventories. It is best used as supplemental information to augment what they are already doing. OAQPS hopes that the data will get better in the future, but they cannot use it in a definitive sense right now.

Dr. Aneja continued by stating reactive nitrogen is a major component in PM, of which ammonia is a very significant contributor and then asked how he plans to go about addressing SAB. Mr. Wayland said there is no requirement to measure ammonia, only criteria pollutants. Can they invest in monitoring techniques? It is a precursor to $PM_{2.5}$. He said as they ratchet down sulfates and nitrates, ammonia becomes a bigger player.

Erika Sasser, OAQPS

Dr. Erika Sasser introduced herself as Director of the Health and Environmental Impacts Division in OAQPS, which is one of the main regulatory offices within the Office of Air and Radiation. Her division is responsible for the review of the National Ambient Air Quality Standards for health and welfare, economic and cost-benefit analyses for major air regulations, and risk analyses in support of air toxics regulations. They also support international policy initiatives.

She expressed appreciation for the continual communication between ACE senior managers and OAQPS. She said that her organization works with a number of ORD programs, and they continue to be impressed with the transparency and communication of ACE. The dialogue between ACE and OAR ensures we can translate ORD science for use in informing OAR decisions.

Throughout the previous research cycle, ACE has consistently delivered high quality research that is targeted towards addressing gaps and uncertainties in the air pollution health literature. Specifically, ACE research has addressed critical air pollutants and health effects, such as cardiovascular disease; and has helped improve our understanding of the role of individual pollutants within the overall mixture of air pollutants to which U.S. populations are exposed. In addition, ACE has worked closely with OAR to identify and address critical uncertainties related to deposition of nitrogen and sulfur and related effects on ecosystems.

The balance of intramural and extramural research is appropriate and the STAR grant program continues to be an excellent vehicle to address highly relevant research areas. We are pleased to see that the new structure of ACE, with the emphasis on public health, still recognizes the important role that ACE must play in providing research on critical uncertainties and newly developing health endpoints, such as neurological and reproductive outcomes, related to the NAAQS reviews. While we have made considerable progress in protecting public health through our National Ambient Air Quality Standards, it is important that each review incorporate the best, most comprehensive science available. ACE's targeted research efforts continue to help us address remaining gaps.

Looking forward, Dr. Sasser mentioned a couple of things in particular. First, the ongoing and planned research on understanding heterogeneity in air pollution related health effects across regions and cities will be very useful in the upcoming review of the particulate matter NAAQS. In addition, efforts to synthesize information by linking findings of clinical and toxicological studies to those from epidemiological studies will enhance the policy relevance of the overall body of research.

Dr. Sasser observed that ORD has turned in some interesting new directions as well. We applaud the overall ORD effort to address public health challenges through engagement with communities. In moving forward in this work, it is essential for ACE to maintain a balance with core research to support OAR programmatic needs. We believe that most resources should be directed towards that core research, while ACE more gradually explores and expands its efforts towards more direct interaction with communities and individuals. And within the realm of

community focused research, we continue to be most interested in how to reduce air pollution to reduce risk. Understanding who is most at risk from air pollution is quite useful, and we want to know how targeted reductions can help those populations. We are less interested in research focusing on how populations can change their behaviors to reduce air pollution risks. In other words, we want to reduce air pollution, not try to figure out how people can reduce their exposed to it. It might be true that changes in lifestyle or diet can reduce risks, but those are costly strategies too and OAR's mandate is to provide clean air and a healthy environment.

We also want to emphasize the need for all of the newly defined areas within ACE to be closely coordinated to maximize the ability to synthesize across related areas. For example, the work on NOx and SOx deposition proposed under PEP-3 should be clearly linked with the work on modeling under AIMS-2, and the work on critical loads of nitrogen under CIVA. In addition, this work should be linked with research on ecosystem services that is occurring in the Sustainable and Health Communities program. In general, work remains to ensure coordination across ORD programs. There are some cross-cutting "roadmaps" (e.g., Nitrogen) but these do not clearly shape research agendas within specific ORD programs. In addition, there are a number of important cross-cutting areas (e.g., Cumulative Risk) that do not have roadmaps yet. Creating better linkages across programs would be helpful.

Discussion

Dr. Arnold began the discussion by saying Dr. Sasser emphasized lowering the pollution rather than reducing exposure. For climate change, it will not be possible to lower exposure, so changing behavior is needed. He asked if Dr. Sasser has considered that and what role she saw ACE playing. Dr. Sasser replied stating OAQPS needs to understand how people are exposed. Her point was that they are not in a position to change lifestyles, so they want to reduce the exposure. With regard to climate change, OAQPS wants to understand the health and climate linkages. Dr. Arnold asked if OAQPS was thinking about what ACE can do and to elaborate on how much coordination is needed. Dr. Sasser said more of the basic climate science is coming from AOP.

Dr. Kinney stated Dr. Sasser's division is focused on individual pollutants by law. He continued by saying she is looking at pollutant mixtures as a whole in some respects. He then asked if she had thought about how that can be implemented. Dr. Sasser stated they are looking at the overall burden and how to characterize that burden. OAQPS has not gotten very far. In terms of a program to look at multipollutants, OAQPS has a long way to go. The multipollutant ISA to support the NAAQS hit stumbling blocks. Dr. Kinney commented that OAQPS cares about proximity of communities to sources when looking at multipollutant mixtures.

Dr. Aneja asked what recommendations they are making to ORD. Dr. Sasser replied stating one of the areas they see is the work on sensors. OAQPS's concern stems from sociology. Basic science communication and outreach is where they see ORD operating in the new term.

Dr. Mitchell stated that in addition to temperature changes, major changes in the water cycle is an issue. Dr. Sasser said from an air perspective, OAQPS has not dealt with water-related issues. Dr. Costa answered by saying it is part of what ACE is trying to do in their holistic approach. Dr.

Miller continued by saying that Ms. Reiley would have talked about that. The EPA is looking at those within the ACE program as well as within ORD's other research programs (e.g., harmful algal blooms).

Dr. Zhao continued the discussion by stating he had heard a concern of crowding out of fundamental research by community engagement. Dr. Zhao asked what degree was this concern shared by other program offices within EPA. Mr. Wayland commented that OAQPS wanted to strike a balance. Ms. Tyler explained it is a fine line. At the regional level, the EPA wants to listen to their stakeholders, but they do not want to forgo the research that is relied upon. Dr. Sasser continued by saying OAQPS needs to be clear how we define community. They have been able to go through physicians to reach the community.

Dr. Arnold explained they heard some discussion about the ebb and flow of interest and budgets and that methods research is on the ebb tide. Dr. Sasser said she would endorse the idea that methods work are not getting the funding that they need and deserve. What gets focused on is regulatory priorities that have to get done and the near-term things. Mr. Wayland commented that OAQPS's monitoring techniques are dated. They need to push traditional methods and invest in the future. They need something to bridge that future. Dr. Arnold commented that there are major QA/QC concerns and nitrogen dioxide measurements need to be done.

Poster Session

The BOSC ACE subcommittee members viewed ACE program research posters.

Discussion
Dr. Viney Aneja, BOSC ACE Chair

Dr. Mitchell asked what the plans are for the next ACE Jamboree and if the members present would be welcome. Dr. Costa replied that ACE tried to do that last year. There is some sensitivity on the part of the program partners to the extent to which they can be frank. Dr. Costa does not believe he heard anything different than he did at the Jamboree. It would allow everyone to see the dynamic of the group (150 people on the phone and 50 on the webinar). He did not make any promises; that was something ACE would have to work out on their end.

Dr. Werner asked if they meet any other times and if they have phone conversations. Dr. Costa explained that is up to the subcommittee and how they would like to stay connected with them. Dr. Costa mentioned there could be a periodic conference call. The Jamboree activity is not a simple or inexpensive undertaking. ACE feels the Jamboree does a good job representing where they are going. They have a number of webinars over the course of the year that are open to the public that the subcommittee would be welcome to participate at. If the group met as a body, there would be some limitations. Dr. Benner commented that the subcommittee can have follow-up conference calls. If the subcommittee wanted to get together and deliberate before they finish the report, the deliberation had to be an open meeting (e.g., FR notice). The public has to have access to any FACA meetings.

Dr. Aneja asked if Research Triangle Park (RTP) or Washington, DC, was the only location where it could be held. Dr. Costa explained it would depend on the size. The Jamboree occurred in RTP due to their locations, but other locations are possible. Dr. Geffen commented that the subcommittee should ask Dr. Costa for any information the subcommittee might need so he can provide it the second day of the workshop. Dr. Aneja said the subcommittee should describe how best to address the five charge questions and write them up because they are obliged to provide this to EPA. The hope is that before everyone leaves after the workshop, there should be at least a working draft. Then, they can go home and flesh it out. Dr. Aneja reiterated that ICF International would provide minutes. The subcontractor would also take notes on any deliberations the second day of the workshop. Dr. Aneja offered to put a draft on the table. One option was assigning two members per charge question. They could also meet as an entire subcommittee and discuss the five charge questions. Anything else in between is also an option. Dr. Zhao commented that one approach is to block half an hour for subcommittee members to say 1–2 sentences about each question and then divide into groups of two and address the questions. Dr. Costa expected no more than a 10-page report and the contractor will prepare the bullets. Dr. Benner explained the report has to go through BOSC review and would be a report from the BOSC to the EPA. Dr. Aneja explained the report timeframe is by November or December 2015 for the executive committee meeting. Dr. Miller explained that the charge questions look at how ACE does things rather than the science. Dr. Aneja said that the subcommittee would meet as a group in the morning with the bullets prepared, and Dr. Costa noted the materials would also be provided at that time.

Wrap-up and Adjourn

Dr. Benner dismissed the group for the day.

Friday, June 19, 2015

Program and Regional Office Perspectives
Dr. Viney Aneja, Chair

Dr. Benner opened the meeting at 8:30 a.m. Dr. Aneja welcomed the group and thanked EPA for its hospitality and the subcommittee for its contributions to the previous day's discussions. He suggested beginning Day 2 with a discussion of the charge questions, breaking for public comments, and finally developing a draft document.

Before the subcommittee began discussing the charge questions, several other questions and comments were addressed. Dr. Costa requested a debrief be provided at the end of the deliberations, and Dr. Aneja said that one will be provided. Dr. Geffen suggested that the subcommittee come to closure as much as possible and to have any additional questions prepared for EPA by 12 p.m. to guarantee that they are resolved. Dr. Anjea stated that Dr. Benner suggested the subcommittee hold a conference call to discuss the document in more detail, but that the subcommittee will need to make a collective decision regarding the call.

Charge Question 1: Given the research objectives articulated in the StRAP, are the topics and project areas planned and organized appropriately to make good progress on these objectives in the 2016-2019 time frame?

Dr. Kinney commented that ACE has an extremely strong research portfolio, but he noted that the subcommittee could address climate issues more fully. He pointed to better characterizing exposures to heat, humidity, and pollen as well as more thoroughly monitoring the health effects of wildfires.

Dr. Kenski noted the difficulty of making judgments on ACE's ability to make adequate progress without some indication of the allocation of work between intramural and extramural research.

Dr. Geffen lauded the Agency's shift in strategic direction and research objectives. She remarked that the research objective makes sense and the program holds together quite well. The specific draft outcomes identified in the StRAP lend some concreteness to the broad objectives. She encouraged the Agency to stick with their strengths (e.g., atmospheric systems). She also noted that the systems approach is critical and EPA can provide a unique understanding of multipollutant, multimedia, and multi-systems impacts. She applauded the decision to shift resources away from control technologies. Finally, she cautioned against investing in social sciences and suggested partnering with the National Science Foundation (NSF) on particularly important topics.

Dr. Arnold commended EPA on their repositioning and rebalancing of their StRAP. He pointed out that the StRAP could be improved by specifically mentioning climate change and believes they could be drawn together without rearranging many of the outcomes. He echoed Dr. Kenski's comment, noting that more information regarding FTEs, contractors, and internal versus external research should be addressed more thoroughly. Dr. Arnold also noted that an increasing shift toward internal research will support integration around climate science and better prepare ACE for some of the products described the previous day.

Ms. Smith agreed with the previous comments. She added that the three research objectives in the StRAP are broadly written and noted that the challenge for the individuals focusing on this charge question is to spend time defining the measures of good planning and organization, given the priorities.

Dr. Mitchell pointed out that it is difficult to see how separate or integrated air, climate, and energy are. The Jamboree document stated ORD and partners have spent considerable resources to build the ecosystem and that it would be nice to show examples of what the ecosystem building has provided and how it will develop further in the future.

Dr. Senior observed that the topics and project areas seem to be aligned well with Agency priorities, but mentioned some exceptions. She would like to see the diffuse activities related to oil and gas pulled together. She also noted that the STAR program seems very well integrated and there are adequate opportunities for regional and program offices to provide input, which is important. She said it was not clear how they are selected at the level of individual research programs and initiatives. She recommended making a clearer connection between the programs

and the priorities at a lower level, because much of the important work that ACE does with the program offices directly is not captured in the plan. Core areas and skills that ACE needs to support the Agency's mission should be identified and nurtured, though it is likely that there may be some necessity to maintain some core skills that might be at odds with strategic objectives.

Dr. Werner suggested that perhaps some percentage of ACE's budget should be set aside for innovative research that is not directed by the partners. He noted that it was not obvious how specific research areas were related to the objectives or to each other. He also remarked that he would like to see better integration of the measurement work with the emission inventories, both in terms of criteria pollutant toxics and climate.

Dr. Zhao noted that the StRAP is a well-developed document with good input, but pointed out the importance of making explicit the air pollutant impacts of hydraulic fracturing. Responding to Dr. Geffen's previous comment, he argued that the social sciences should not be ignored and the societal impacts of research are important to consider. However, he recommended against ORD having a heavy social science focus, but rather focus on incorporating social science into its research objectives. Dr. Zhao also observed that having an element of social science will improve community engagement and also suggested an increased emphasis on synthesizing and effectively communicating research findings to the public.

Dr. Aneja stated that he would like to see the Agency have a program that takes into account rapid response. That is, identifying how ACE responds if there is a crisis or new emerging issue. He also pointed out the importance of considering funding in the context of rapid response.

Dr. Kinney and Dr. Arnold will address Charge Question 1.

Charge Question 2: How effective are the approaches for involving the EPA partners in the problem formulation stage of research planning?

Dr. Kinney stated that the approaches are highly effective.

Dr. Kenski commented that she would like to see ACE program make more effort to involve states in the project formulation process, because they are major end users of the data. Noting that the regional offices convey the desires of the states and that the regions do not work on some of those particular tasks, she suggested it would be better to get the information straight from the users.

Dr. Geffen agreed with Dr. Kinney; she was impressed and would like to see in the reports the comments from the regional partners regarding trends in increase and improvements over the past 3–4 years. She observed that the Agency is using a broad and diverse set of approaches and commended ACE's creative communication techniques and materials. Dr. Geffen disagreed with Dr. Kenski about the role of states in project formulation, noting that it depends on the regions as to how well the states are engaged. She remarked that it is something that might be explored in more detail.

Dr. Arnold agreed with the previous comments. He mentioned that the approaches have been effective, but not particularly efficient. He was unsure how to make the process more efficient. He noted that if something is not organizationally constructed, individual communications disappear with the individual.

Ms. Smith added that although the group heard about opportunities for partners to become involved with the problem formulation stage, it was anecdotal and may not have been representative of a broad range.

Dr. Mitchell agreed with the other panel members on the effectiveness of the approaches. He noted that a systems approach must be used for the program to remain effective, which requires funding and people to perform the systems analyses. He also commented that it will be a balancing act of how to use resources.

Dr. Senior commented on the importance of process, noting that she does not believe an innovative culture can exist without well-defined boundaries and problems. She noted that ACE scientists must have a good sense of what the problems are, so that they can develop the best responses. Many interactions are informal, and some interactions are efficient and some are burdensome. She urged for balance between innovation and structure.

Dr. Werner agreed with Dr. Kenski on the importance of involving states, because they are in the field and ensure compliance. He commented that it would be interesting to see how universal state responses would be regarding the need for new tools.

Dr. Zhao added that stakeholder involvement is not just driven by the mechanism of interaction. He noted that whether they want to get involved also matters and if their needs are addressed, they will want to become involved.

Dr. Geffen and Dr. Mitchell will address Charge Question 2.

Charge Question 3: How well does the program respond to the needs of EPA partners (program office and regional)?

Dr. Kinney stated that it seems as though the research program is heavily influenced by the needs of OAQPS and that creating more of a balance across the offices is important.

Dr. Kenski noted that the charge question defines EPA partners narrowly and that she would like to see the states included explicitly as partners. She also suggested that methods development, emission source characterization, and improved understanding of atmospheric chemistry must be stressed.

Dr. Geffen commented that the tension between program office needs, regional office needs, and motivating factors for the scientists is likely to be a continued challenge, particularly given ACE's new directions. She added anecdotal evidence of where research results are being used exists.

Dr. Arnold agreed with Dr. Kinney's prior comments. He added that the balance between responding to stakeholder needs and individual PIs and ready-response to short-term issues is delicate. He continued by saying the research plan describes well the change in direction to get away from "University of ORD" and to become more welcoming to statements of need. In his opinion, the program responds well to the needs based on what feedback the subcommittee has received to this point. He cautioned that the balance must be achieved carefully.

Ms. Smith agreed with Dr. Kenski on the value of the formal inclusion of states as a defined partner, but agreed with Dr. Werner in that doing so will likely reveal what the biggest challenges are in the field.

Dr. Mitchell noted that a balance must be struck between responding to particular needs and integrating what partners are doing across the whole program. He added that incentives will be needed to reward integration.

Dr. Senior echoed the sentiments expressed previously. She added that the subcommittee is dealing with anecdotal information given the lack of metrics needed to answer the question. She also commented that the program offices seem happy with the structure and communication channels to get what they require from ORD, but they would like more synthesis work, which will necessitate a discussion regarding whether it is an appropriate role for FTEs.

Dr. Werner commented that the challenge is responding to an immediate need and simultaneously figuring out future needs, especially related to climate change.

Dr. Zhao suggested establishing a quantifiable tracking system of ORD researchers and PIs responding to short-term needs and quick responses with results feeding into the rewards system (e.g., promotions).

Dr. Werner and Dr. Kenski will address Charge Question 3.

Charge Question 4: Please comment on the quality of the products delivered by the program. Are there additional approaches that could be taken by the program to ensure that its products are of high quality?

Dr. Kinney commented that EPA has done a remarkable job of producing high-quality research findings both internally and in its extramural STAR grant program. He added that the external funding has been supporting some of the leading research groups in the world, despite shrinking budgets. The uncertain nature of the STAR programs is difficult and more funding for intramural and extramural work is important.

Dr. Kenski agreed with Dr. Kinney that the program deliverables are high-quality products. She urged the subcommittee to resist the efforts to quantify the impact in terms of number of publications and citations, because the value of ACE projects is far greater than the number of users might imply. She added that internal and external peer review as well as input from users will keep the quality of these products high.

Dr. Geffen also agreed, noting the outstanding nature of the quality of the research. She added that finding leaders in the field and thinking through metrics and reviews as the program moves into areas such as climate, where it has not been as strongly engaged, will be important.

Dr. Arnold remarked that the quality of program deliverables is astonishing and, considering the budget, the efficiency is higher than any similar program. He warned against writing off counting publications, because ACE is still a research program. He added that a suite of evaluation metrics are needed to capture the utility of other approaches. If quality can be shown using multiple metrics, the need for additional funding can be supported.

Ms. Smith noted that the charge question has two parts: one side is looking back and the other is looking forward. She added that the subcommittee may need more details about ORD's quality assurance procedures that are currently in place.

Dr. Aneja voiced his opinion for placing an explicit value on publications, especially in high-value journals. He also commented that there is an opportunity for ACE to partner with other agencies, noting the U.S. Department of Agriculture (the largest contributor to atmospheric ammonia) in particular, because ammonia is a precursor of PM formation and effective management of PM will require ammonia monitoring.

Dr. Arnold responded that there is a lot of research work that is going on that is different from monitoring, pointing specifically to Dr. John Walker's research. He added that ACE can work on techniques, because they do not know how to monitor for ammonia. So while it is one element that could be emphasized, he argued it is not accurate to say it is not present.

Dr. Mitchell recognized the need for a standard way to associate research with publications and to weight the impacts (e.g., changes the direction or emphasis of research).

Dr. Senior noted that considerations should be made to maintain a consistent QA approach between shorter-term work and longer-term research priorities. She also suggested measuring the impact of community outreach.

Dr. Werner also agreed that the research projects are excellent, but commented that the challenge will be maintaining that level of excellence in new research.

Dr. Zhao agreed with the prior comments regarding high-quality research products, maintaining a focus on publications, and utilizing multiple evaluations metrics. Regarding outreach and responding to short-term needs, he added that it will be important to keep the quality high, and that doing so will require basing these activities on a solid foundation of science and research.

Ms. Smith drew attention to the tension that can stem from collaborative research, specifically regarding determining primary authorship.

Dr. Arnold noted that the order of authors is a great element for consideration in multiple evaluation metrics, and that the differences between fields should be recognized.

Dr. Senior and Dr. Zhao will address Charge Question 4.

Charge Question 5: How well have we translated research findings and understanding for the end-users? How can we improve our ability to translate research findings and understanding for end-users in the future?

Dr. Geffen commented that translation is something that EPA does quite well, and pointed specifically to the synthesis reports as an example. She noted that translation for use by stakeholders and partners is good, but the evidence that research is translating to policy is less clear.

Dr. Arnold countered by saying there could be significant improvement in translation across the board. He pointed to translation as the weak link between an astonishing set of work products. He suggested considering institutionalizing some of the methods for translation and noted not only that translation must to be bidirectional, but that stakeholders must be involved early.

Ms. Smith noted that the subcommittee heard the word "synthesis" and about the need for research synthesis quite a bit during the meeting. She said that answering the charge question depends on how the end user is defined. Are end users strictly EPA partners? Is it more broadly defined?

Dr. Costa responded that there are a lot of end users, from the program level, down to the states, and to the public. He pointed out that the primary client is the public, noting that this should not diminish the role of the program and regional offices. He also commented that EPA cannot regulate to sustainability, due to gaps and areas where progress will be more difficult. To this end, public engagement will be critical.

Dr, Miller commented that ACE's challenge is to do the work so that partners, who have connections with the public, can communicate the findings. He added that the partners would likely see themselves as the end users, but noted the importance of translating the science in a way that the public can use it. Although the goal is to develop science (e.g., models, data) for direct use by the experts at the state- or local-level, ACE needs to be able to convey the sense of that science to the public.

Dr. Arnold pointed out that ACE cannot engage all stakeholders, which is why the organizational structure includes regional offices. He stated that the public must be considered at the onset of research.

Dr. Werner commented that he likes that ORD reaches out to the public as an educational arm of the Agency, as opposed to the enforcement arm.

Dr. Costa replied that ORD has to be careful about how it engages the public.

Dr. Vette stated that ORD has a division that is specifically directed to coordinate community outreach. He added that ACE still needs to translate its own research, but such things exist within the Agency.

Dr. Arnold noted that successful public engagement will help ACE get more support.

Dr. Costa offered Village Green as an example of successful local-level outreach.

Dr. Mitchell remarked that the better term may be "users," as some are involved in processing the information and giving feedback to EPA. "Users" makes the term more comprehensive and iterative.

Dr. Senior stated that it is hard to answer the charge question without understanding whether there is a communication plan within ACE to get results to various stakeholders or users.

Beth Hassett-Sipple responded that ACE does have a current plan, as well as shorter-and longer-term goals, which are contained in the ACE communications.

Dr. Zhao commented that ACE has great scientists doing research, which can be thought of as a production process that generates outputs that can be used by multiple entities. He added that considerations must be made to maximize the types of products developed from a single project. He noted that there is a division of labor in producing the outputs, and that it is not realistic to expect every scientists to do marketing or sales. Scientists have to do some of the projects (e.g., technical reports), but other things (e.g., newsletters) can be done by others. Ultimately, the translation of research is the critically important aspect.

Public Comments
Dr. Viney Aneja, Chair

No public comments were made.

Subcommittee Discussion and Writing

Before drafting the charge question responses, Dr. Costa offered some additional insight into the ACE program structure and budget. He noted that there are five current topic areas that reflect an annual budget of $27 million. He also stated that although project-specific allocations change for fiscal year (FY) 2015, topic-level distributions remain consistent. OAQPS will maintain a heavy programmatic emphasis, but states have submitted lists of needs, which focus primarily on hydraulic fracturing, wildfires, and monitoring.

Dr. Arnold asked whether it would be helpful for the subcommittee to make requests regarding topics that ACE should be supported to research. Dr. Costa responded that such recommendations would be considered. Dr. Vette commented that specific recommendations for metrics would be helpful.

Dr. Aneja requested that participants move to their assigned breakout groups to draft their group responses to the charge questions.

Subcommittee Discussion and Writing Summary

Dr. Aneja welcomed the subcommittee back from lunch and asked a representative from each group to summarize the highlights of the response to their respective charge question drafted during the previous session.

The draft response to Charge Questions 1-5 are included in Appendix C

Charge Question 1: Given the research objectives articulated in the StRAP, are the topics and project areas planned and organized appropriately to make good progress on these objectives in the 2016-2019 time frame?

Dr. Arnold summarized the draft response to Charge Question 1. He highlighted a focus on increasing the scope of climate change and human health research to include effects of heat, humidity, and pollen. He also pointed to the need for ACE to reconsider the balance between intramural and extramural research and might need to integrate the efforts, especially around topics such as oil and gas. The final comment related to determining the role of the social sciences in ACE research, as there was a debate within the subcommittee regarding the extent to which social sciences should be considered.

Charge Question 2: How effective are the approaches for involving the EPA partners in the problem formulation stage of research planning?

Dr. Mitchell summarized the draft response to Charge Question 2. He noted that ACE has done a good job describing the approaches of both the program and its partners but commented that the inputs for these programs are less clear. His second point suggested directly involving states in the problem formulation, as states' points of view might not be reflected in Regional views. He also commented that ACE does a nice job balancing short- and long-term goals, but it should reinforce its priorities through clear communications.

Charge Question 3: How well does the program respond to the needs of EPA partners (program office and regional)?

Dr. Kenski summarized the draft response to Charge Question 3. She remarked that ACE has been quite responsive to the needs of EPA partners. The draft response encourages defining partners more broadly, to include states, regional planning organizations, and other entities with vested interests in ORD outputs. She also noted that the ACE research plan is heavily influenced by OAQPS and, while this is appropriate, ACE should acknowledge its other partners and find a balance. She also pointed out that ACE should strike a better balance between immediate needs and long-term priorities. Other highlights included the suggestion of reaching out to subject matter experts, particularly related to climate research, and developing a specific research plan for developing smaller, cheaper sensors for use in monitoring NAAQS compliance.

Charge Question 4: Please comment on the quality of the products delivered by the program. Are there additional approaches that could be taken by the program to ensure that its products are of high quality?

Dr. Senior summarized the draft response to Charge Question 4. She began by recognizing the high-quality research conducted by ACE. She noted that existing evaluation metrics should take into account the specific field of research and also noted the importance of additional metrics to evaluate outreach and engagement. Dr. Senior also pointed out that shorter-term research must maintain similar quality, even though full quality assurance might not possible. She also touched on developing appropriate incentives and rewards for engaging in collaborative work. Other points included the concern regarding a lack of continuity for externally funded topics given cyclical funding and maintaining the long-term quality of ACE research by preserving ACE's core research and skills.

Charge Question 5: How well have we translated research findings and understanding for the end-users? How can we improve our ability to translate research findings and understanding for end-users in the future?

Dr. Zhao summarized the draft response to Charge Question 5. He expressed the sentiment that end-users seem pleased with the current state of research translation, but noted there is a lack of data to substantiate these anecdotes. He also commented that it will be important for ACE to clarify the definition of "end-user," which could include other researchers, ACE partners, policy makers, and the public. The draft response suggested incorporating rewards and incentives as well as bidirectional translation.

Wrap-up and Adjourn

Dr. Aneja expressed his excitement regarding the in-depth discussions and the completion of the ACE program review draft report. He thanked the subcommittee members for their rigorous and transparent deliberations.

Dr. Benner asked that he be carbon copied on any further email discussions regarding revisions to the draft document after the close of the meeting, as emails must be included in the public record. He thanked the subcommittee members for their time and energy and adjourned the meeting.

Appendix A: Agenda

United States Environmental Protection Agency Board of Scientific Counselors (BOSC) Air, Climate, and Energy (ACE) Subcommittee

Meeting Agenda – June 18-19, 2015

Research Triangle Park, North Carolina

TIME	TOPIC	PRESENTER
Thursday, June 18, 2015		
8:00 - 8:30	Registration	
8:30 - 8:45	Welcome, Introduction, and Opening Remarks	Viney Aneja, Chair
8:45 - 9:00	DFO Welcome	Tim Benner
9:00 - 9:15	Program Summary and Discussion of Materials Provided	Dan Costa
9:15 - 9:45	Review of Charge Questions	Viney Aneja, Chair
9:45 - 11:00	Program Purpose and Design (questions 1 and 2) • EPA Overview • SC Discussion	Dan Costa Subcommittee
11:00 - 12:15	Program Effectiveness and Quality (questions 3, 4, and 5) • EPA Overview • SC Discussion	Dan Costa Subcommittee
12:15 - 1:30	Lunch	
1:30 - 2:30	Program and Regional Office Perspectives	TBD
2:30 - 3:45	Poster Session	ACE Project Leads
3:45 - 4:30	Discussion	Subcommittee
4:30 - 4:45	Wrap-up and Adjourn	
Friday, June 19, 2015		
8:30 - 9:30	Subcommittee discussion EPA response to Subcommittee questions	Subcommittee Dan Costa
9:30 - 9:45	Public comments (if any)	
9:45 - 12:00	Subcommittee discussion and writing	Subcommittee
12:00 - 12:45	Lunch	
12:45 - 2:15	Subcommittee discussion and writing	Subcommittee

2:15 - 2:30	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 (absent)
Charlette A. Geffen
Donna M. Kenski
Patrick Kinney
Myron James Mitchell
Constance Senior
Art Werner
Jinhua Zhao

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

EPA Presenters:

Dan Costa, *Office of Research and Development, National Program Director for the ACE Research Program*
Rich Cook, *Office of Transportation and Air Quality*
Ben D'Angelo, *Office of Atmospheric Programs*
Mary Reiley, *Office of Water*
Erika Sasser, *Office of Air Quality Planning and Standards*
Patti Tyler, *Region 8*
Chet Wayland, *Office of Air Quality Planning and Standards*

Other EPA Attendees:

Rich Baldauf
Britta Bierwagen
Rebecca Dodder
Aimen Farraj
Megan Fleming
Anne Grambsch
Beth Hassett-Sipple
Sherri Hunt
Bryan Hubbell
Mark Ihyuch (?)
Stacey Katz
Vasu Kilaru
Sue Kimbrough
Andy Miller
Carlos Nunez
Jason Sacks
Laurel Schultz
Lindsay Stanek
Bill Russo
M. D. Hays
Ron Williams

Other Participants:

W. M. Battye, *EC/R*

Contractor Support:

Wendy Jaglom, ICF International
Whitney Mitchell, ICF International

Appendix C: Charge Question Draft Responses

Charge Question 1: Given the research objectives articulated in the StRAP, are the topics and project areas planned and organized appropriately to make good progress on these objectives in the 2016-2019 time frame?

At the most general level, yes, the topics and project areas are organized appropriately to make good progress against the research objectives in the StRAP. Alignment of topics and project areas with research objectives at several specific points, however, would be stronger with some additions or reconfiguration.

One of those specific points is the planned increased research work around climate change threats, impacts, and responses. The human health and environmental impacts of climate change are a crucial part of EPA's expanding focus on greenhouse gas reductions – climate change mitigation – and adapting human and natural environments to specific climate change threats.

For this reason, the climate change-related human health epidemiology and environmental impacts modeling should be emphasized more explicitly throughout the program. For example, as climate continues to change and changes accelerate, wildfire risk is increasing, significantly in some locations in the western US and AK. ACE could emphasize or extend several aspects of its planned research to integrate objectives on air quality emissions and modeling to include. Work on climate change-related human health effects naturally crosses many Federal agencies and non-federal partners, but EPA's mission requires it to have a crucial, and potentially central, role. This supports ACE Objective 1: Assess Impacts.

Heat exposure is the most direct and largest current health risk factor related to climate change effects and humidity also plays a key role in thermal comfort. The NOAA human health heat index, for example, uses surface air temperature (Tas) and relative humidity (RH) in computing apparent temperature, one measure of heat stress. For this reason, climate change and air quality modeling research and products from ACE should expand work to include RH in future projections at all scales relevant to impacts and vulnerability studies. This also provides a useful means to include progress and products from the very successful ACE air quality model development and evaluation work to the newer work on climate change.

Pollen release and transmission and associated allergic diseases are sensitive to [CO_2], Tas, and precipitation, all of which are projected to continue changing in in the near and far future as a function of climate change. However, no systematic, publically available, comprehensive environmental monitoring network exists for pollen, so a research opportunity may exist here for ACE. This supports Objective 3, the call for environmental monitoring and metrics needed to adapt to the impacts of climate change.

The committee suggests that its recommendations here on the alignment of research objectives with projects and outcomes would be more strongly grounded if it had a more detailed understanding of resource allocation, even with the complexities of splitting out funding components that are mixed across sources, locations, and timelines.

The committee strongly approves of the rebalancing of ACE objectives to increase its emphasize on products to be delivered to internal EPA clients and partners, but cautions the Agency to continue to include time and support for PI-initiated research to prepare EPA for future needs which may not be especially apparent now. ACE should also retain flexibility while implementing its plan to provide fast turn-around products to its internal partners and clients when crucial needs arise quickly. These two aspects add to the increased emphasis in areas like climate change and multi-pollutant research to expand – potentially very greatly expand – the work of ACE. For this reason, the committee suggests that ACE consider looking at its levels and balance of intra- and extra-mural research to help ensure that it can meet its increased obligations to deliver products to its partners and clients in addition to traditional peer-reviewed research publications.

In several places – work around emissions from oil and gas extraction, e.g., – the research program is not as well integrated as it might be, with the result that this work can appear as separate projects rather than part of a program. This example emphasizes the need for more articulation of the systems approach across all the ACE research objectives and project areas.

The committee remains unsure of the appropriate level of increased social science research in ACE and repeats the caution expressed by OAQPS Health and Environmental Impacts Division Director that this should remain a smaller part of the research and not reduce the impressive physical and biological science work which is the hallmark of ACE. Social science inputs can perhaps be usefully developed by ACE in consultation with other agencies which have substantial investments already in social science research – NSF, etc.

Charge Question 2: How effective are the approaches for involving the EPA partners in the problem formulation stage of research planning?

The committee applauds the ACE program for its breadth and diversity of approaches used for engaging its partners. The approaches used are broad-based and highly effective, but the committee believes they could be more efficient in terms of processes used for coordination. It was unclear on the extent to which input in planning is being provided by other offices within ORD, which will be necessary to implement the systems approach.

EPA also needs more effort to directly involve the states in problem formulation stage, since they are significant users who both need and can provide information. Their interests and points of view are not always fully represented by the regional partners. Direct involvement could help on-the-ground perspective of needed tools and the ultimate transfer of research accomplishments into use and operations.

Using a systems level approach from the outset that defines linkages among research elements and partners needs can create an architecture for research planning and coordination, as well as provide a framework for other communications. The graphic (slide 17 from Dr. Costa's ACE overview presentation June 18, 2015) showing the relationships between air, energy and climate and the way in which the five core themes fit into the new directions is a good start, and can serve as a foundation that needs to be built on using a systems approach to more clearly articulate how the interactions across program areas will be driven, evaluated and used. It will be

important to link the program structure and investments to the strategic themes and priorities, and such a systems framework can illuminate the connections among these elements of the plan. We recognize this may require additional resources (or a reprioritization of current activities) but should have a high priority.

The ACE subcommittee applauds the stated priority that EPA is placing on coordinating the elements of this program. The program will be aided by reinforcing priorities and needs and clear communications of the systems approach and new directions across the entire ACE program. This will support the drive to shift the culture in ORD and help focus precious FTEs on the highest priority challenges. The subcommittee thinks that ACE is doing a good job in managing the tension between serving near term user needs and longer term research priorities. Utilizing an overarching framework and systems approach from the outset can enhance the program and help manage that process could also help maximize the impact of the program on advancing our understanding of interdisciplinary air, climate and energy problems.

Charge Question 3: How well does the program respond to the needs of EPA partners (program office and regional)?

In general, the Committee feels that ACE has been very responsive and the partners we heard from at the meeting were pleased. We encourage ACE to define partners more broadly to include state air program agencies and regional air planning organizations.

The research plan describes very well the transition away from "University of EPA." The research agenda seems very heavily influenced by OAQPS for historical reasons, proximity of staff, and the large regulatory responsibility of OAQPS. Emissions, monitoring, and atmospheric science (modeling) should continue to be priorities to support OAQPS and state needs.

At the same time ACE needs to be responsive to the needs of other partners and find a workable balance. Simultaneously, ACE needs to identify a process to include other partners in priority setting. The committee acknowledges the tension between regional office and program office needs and individual scientists' expertise. Another challenge is balancing responding to immediate needs with addressing future research needs and integrating across programs. Both the committee and partners we heard from emphasized the value of synthesis documents.

Increased emphasis needs to be put on developing new or replacing outdated federal reference methods for ambient pollutants. ACE should continue to support the evaluation of small, inexpensive sensors and develop a roadmap for their eventual use for determining compliance with NAAQS.

To address the increasing emphasis on climate, ACE should broaden its approach to setting research agendas by reaching out to a wider collection of experts.

The committee suggested that a quantifiable tracking system on responding to (short-term) needs might be helpful, including inputs from both researchers and partners.

Charge Question 4: Please comment on the quality of the products delivered by the program. Are there additional approaches that could be taken by the program to ensure that its products are of high quality?

The Subcommittee recognizes and appreciates the outstanding high quality research carried out by ACE, both intramurally and extramurally. The quality of the research outputs has been reflected in refereed journal publications (both the number of publications and the rankings of the journals), in citations, in prestigious awards bestowed to ACE research teams (both intra and extramural), and in positive external reviews such as the Integrated Science Assessment for NAAQS.

The Subcommittee deliberated on the additional steps ACE can take to maintain this level of high quality research as the ORD engages in more short-term work in response to programmatic and policy needs, as ACE research areas branch into other fields, and as ACE engages in more public outreach programs.

One approach that the Subcommittee recommends is to develop a set of multiple metrics to measure the productivity and output quality of ORD researchers. It is critically important to continue to track the number of publications, quality of publication outlets, the number of citations, and distinguished awards. However, these traditional metrics should be interpreted with a number of caveats. For example, the impact factors for publications and number of citations vary from one field to another (e.g., economics vs engineering), and as a result, the numbers may not be comparable across fields. Further, numbers alone may not fully reflect research quality and value, and internal and external peer review may be needed to augment such numbers. It is important that peer review activities continue and receive sufficient funding to maintain high quality product.

Further, as ACE increases its efforts in outreach and engagement, it is important to make sure that such efforts are built on solid science that ACE has been conducting. It is also important that the outreach and engagement efforts be conducted in a manner consistent with the state of the art approaches, utilizing results from research in communication and engagement. To ensure the quality of outreach and engagement work, ACE may need to develop a set of metrics for such efforts that should be tracked, for example, hits to websites, hours spent in public outreach activities, publications in engagement journals, etc.

It is important to maintain quality standards when ACE works on short-term projects for the program offices; the complete QA procedure used for peer-reviewed research is probably not appropriate. ACE should consider how to design a streamlined process for maintaining technical quality of the support for program offices.

Collaboration with other researchers within ACE and external to ACE is an excellent way to produce high quality work. Appropriate incentives or rewards should be in place for collaborative work, in terms of promotion, awards, etc.

Lack of continuity in the topics for externally funded research areas is a concern.

To maintain long-term quality of ACE research, it is important to maintain continuity in core research areas within ACE.

Charge Question 5: How well have we translated research findings and understanding for the end-users? How can we improve our ability to translate research findings and understanding for end-users in the future?

The Subcommittee received anecdotal evidence that program and regional offices are pleased with the new ACE structure and with the methods and frequency of communication with ACE. However, we have not talked to a broad selection of offices in coming to this conclusion.

In answering this question, the Subcommittee wished to have a clear definition of what is meant by the end-user. We concluded that the end-user could be other researchers, ACE partners, policy makers, and the public.

The need for synthesis and translation of results of ACE research is critical in order to support policy decisions and particularly as ACE participates in more public engagement. We recognize that PIs are not always best suited to translate research results to all audiences. ACE should identify the appropriate people (technical FTEs) that are best suited to synthesis and/or translation of research work. Rewards and incentives should be in place, because synthesis and translation work does not necessarily result in peer-reviewed publications, yet the impact on policymakers and the public can be great.

Bi-directional communication is essential. Research results must be translated to end users; in addition, end-users should be involved from the beginning in the research. There is opportunity for the technical FTEs who are most involved in synthesis and translation to facilitate this bi-directional communication. Again, rewards and incentives are important for encouraging bi-directional communication.