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

Air, Climate, and Energy (ACE) Subcommittee

BOSC ACE Subcommittee Review of Progress Integrating Social Science Concepts into the ACE Portfolio

Responses to Charge Questions

December 16, 2016

Air, Climate, and Energy Subcommittee

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List of Acronyms

ACE	Air, Climate, and Energy
BOSC	Board of Scientific Counselors
CSS	Chemical Safety for Sustainability
EM	Environmental Management
EPA	Environmental Protection Agency
HS	Homeland Security
NGO	Non-governmental Organization
NSF	National Science Foundation
OAR	Office of Air and Radiation
ORD	Office of Research and Development
QA	Quality Assurance
RFP	Request for Proposal
RTP	Research Triangle Park
SHC	Sustainable and Healthy Communities
SSWR	Safe and Sustainable Water Resources
STAR	Science To Achieve Results
StRAP	Strategic Research Action Plan

Introduction

The U.S. Environmental Protection Agency (EPA) Office of Research and Development's (ORD) Air and Global Change (Climate) research programs have a long history of providing well-defined, scientifically sound products in support of regulatory and policy decisions. These two programs were merged in 2010 to form the Air, Climate and Energy (ACE) research program. The ACE program recognizes the inextricable linkages between air quality and climate and the need to address common issues in harmony. ACE also encompasses studies of energy use and decision-making regarding energy choices and the associated impact on human health and the environment. This vision for integrated research on air, climate and energy sowed the seeds for expanded systems thinking and consideration of factors beyond the traditional technical and scientific bounds of our understanding.

At the same time, independent review bodies have repeatedly recommended to ORD and ACE that systems and solutions-oriented research cannot be fully achieved through technical or regulatory means alone. As ACE has matured and evolved in the last few years, interdisciplinary science[1] with a focus on public and environmental health goals has been embraced. It is the intent of the ACE program that research studies are not only published in scientific journals, but are designed and conducted in collaboration with partners and stakeholders who will use and ultimately translate research results into applications that improve public and environmental health.

The ACE Strategic Research Action Plan (StRAP) published in 2015 provides the program structure to meet the highest priority needs of the overall program and individual regional offices while simultaneously encouraging novel thinking to incorporate interdisciplinary solutions-oriented science.

In June 2015, the EPA Board of Scientific Counselors (BOSC) ACE Subcommittee had its initial face-to-face meeting with the ACE program where ACE provided a broad overview of its vision, structure, and core project-level descriptions. Partner offices also provided their perspectives on the ACE portfolio and supported the alignment with their priorities. A productive dialogue on ACE program balance and overall direction and vision followed, leading to Subcommittee recommendations. The perspectives and constructive commentary provided by the Subcommittee, in combination with the formal recommendations[2], are being addressed by ACE as the program continues to evolve. Among the recommendations was the need for ACE to seek ways to begin the integration of social science into its portfolio – especially if public health were to be nurtured as part of the environmental/public health mission.

Given resource limitations and the need to sustain ACE's traditional support to the development and implementation of air and climate policies, ACE undertook an alternate route to expanding work in social science. ACE enlisted a senior member of the EPA Office of Air and Radiation (OAR) staff trained in social science (economics) to lead the design of an ACE conceptual model for incorporating social science principles into the program fabric. ACE has made considerable progress in developing this conceptual model and in October 2016 asked the BOSC ACE Subcommittee for a focused review and discussion of the approaches described in

[1] "Interdisciplinary" is used in this context to mean connecting and integrating multiple disciplines – and their specific perspectives – in the pursuit on a common task.

[2] Review of U.S. EPA Office of Research and Development's Research Programs (PDF) (https://www.epa.gov/sites/production/files/2016-03/documents/bosc_report_02-29-2016_final.pdf)

the conceptual model to integrate social science[3] with natural/physical science[4] appropriately into the ACE portfolio.

[3] The conceptual model describes social science as a widely diverse set of areas of academic study that includes quantitatively focused disciplines such as economics and more qualitatively focused disciplines such as history and communication studies. Examples of social science disciplines that have been applied in the environmental and public health context include sociology, economics, anthropology, geography, demography, political science, decision science, behavioral science, risk communication, risk analysis, and urban planning. Appendix A of the conceptual model provides a fairly comprehensive listing of social science disciplines and common definitions.

[4] The conceptual model uses physical and natural sciences interchangeably to refer to non-social sciences. This charge question report uses "natural science" as a catch-all phrase for scientific disciplines that deal with the physical world, such as biology, chemistry, geology, and physics. The definition as used in this report includes applied sciences such as engineering.

Background on the Subcommittee Process

In October 2016 ACE provided the BOSC ACE Subcommittee with review materials relating to their activities to integrate social science into ACE research programs, including a draft of the conceptual plan titled "Strengthening the Foundations for Interdisciplinary Social-Environmental Research in ACE", and three charge questions to consider when reviewing the materials. Subsequently, the ACE Subcommittee:

1. Reviewed the draft conceptual plan and related materials (see Attachment A for list of materials);
2. Met with the ACE National Program Director and program staff on October 25-26, 2016 in RTP, NC and listened to ACE presentations (see Attachment B for meeting agenda);
3. Deliberated as a group on the charge questions; and
4. Divided into three sub-groups to draft initial responses to each charge question.

The three Subcommittee small groups drafted specific responses to each charge question after the October 2016 meeting. The Chair and Vice Chair of the Subcommittee prepared an initial draft of the Subcommittee report based on charge question responses provided by the three small groups, circulated the initial draft report to all Subcommittee members, and asked for review comments. The report was revised based on Subcommittee member comments and discussions during a teleconference on December 2, 2016. The recommendations of the ACE Subcommittee in the draft report are based on material provided to us prior to the October 2016 meeting, presentations made during the day and a half meeting, and deliberations during the meeting and after the meeting in teleconference.

This draft report will be submitted to the full BOSC Executive Committee, which will meet on January 10-12, 2017 in RTP, NC to review and discuss draft reports from each of five ORD BOSC subcommittees[5]. The Chair and Vice Chair of the ACE Subcommittee are members of the Executive Committee and will participate in the meeting. The ACE National Program Director, Daniel Costa, Sc.D., and the members of the BOSC Executive Committee will discuss the ACE Subcommittee report during the meeting, ask clarifying questions, provide perspective, and offer comments to the ACE Subcommittee Chair and Vice Chair.

Subsequently, the ACE Subcommittee Chair and Vice Chair will revise the charge question report in response to any questions and comments raised during the BOSC Executive Committee meeting and submit a final report to the Executive Committee after the Executive Committee meeting.

[5] In addition to ACE, the other BOSC subcommittees are Chemical Safety for Sustainability (CSS), Homeland Security (HS), Safe and Sustainable Water Resources (SSWR), and Sustainable and Healthy Communities (SHC) (https://www.epa.gov/bosc/about-bosc-subcommittees).

Responses to Charge Questions

The Subcommittee was charged with three questions as follows:

1. The ACE program has developed a conceptual model for interdisciplinary research that brings together social and environmental sciences to address significant environmental challenges within the ACE research program. What are the strengths and weaknesses of this model in guiding ACE toward a more integrated social-environmental research program?
2. The ACE program is piloting several applications of the conceptual model, including an interdisciplinary problem formulation workshop on wildfire smoke risk communication and management that took place in September 2016. How can the ACE program make this approach more widely applicable to other aspects of the program such as 1) the Climate Roadmap and 2) distributed data collection, e.g., social and economic impacts of air quality sensors?
3. What are other viable, near-term opportunities for integrating social sciences, either within the ACE program or jointly with other ORD research programs, that warrant discussion?

Overall, the ACE Subcommittee found that the vision and objectives in the conceptual model for interdisciplinary research in social-natural science are clearly articulated and provide a sound conceptual approach with the potential to successfully integrate social sciences into the ACE portfolio. As noted in our more detailed comments below, additional information on implementation and resource balance is requested to help evaluate the extent to which this model can be integrated into the ACE programs.

Subcommittee responses to each charge question follow below. The suggestions provided by the Subcommittee in response to each specific charge question are meant to complement and supplement ongoing and planned activities. The suggestions do not necessarily identify deficiencies in the program; but rather, in some cases the point of a suggestion is to endorse the importance of activities and initiatives that are already ongoing or planned and that the Subcommittee feels should receive continuing support.

Charge Question 1

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

We applaud ACE for its proposed innovative and forward-looking approach detailed so thoroughly in the conceptual model described in the report "Strengthening the Foundation for Interdisciplinary Social-Environmental Research in ACE." The complexity of environmental issues within the ACE program demands the interdisciplinary approach described in the conceptual model, and we recommend that the document, in some form, be published in the open peer-reviewed literature. This publication would solidify ACE's leadership in thinking about how to move forward with such an approach, as well as provide additional communication to the natural and social science communities. The journal review process would also provide feedback to ACE from the wider scientific community on this approach. As ACE moves forward, however, we urge the program to find ways to use the conceptual model for appropriate challenges, while at the same time maintaining focus on its base program functions that are also critical to the community (e.g., atmospheric modeling, emissions characterization) and to maintain the strength of those programs with adequate funding, personnel, and partnerships.

The Subcommittee has identified the following strengths and weaknesses of the current conceptual model:

Strengths:

- Overall, the document is extremely well written with sufficient detail to fully describe and capture the nuances of the conceptual model. It gives careful attention to best practices of interdisciplinary collaboration and identifies a broad suite of social science disciplines that could be brought to bear on some of ACE's specific and most important research interests.
- The approach is responsive to the directive to integrate social sciences into the ACE portfolio, and sets a direction that can be used by other parts of EPA to address this same challenge.
- The model emphasizes building networks of social and natural science experts within ACE, as well as within the entire EPA; additional partnerships outside the agency are also included as part of the model and plan.
- The model recognizes the importance of a strong team facilitator to help insure the success of interdisciplinary social-natural science projects.
- The model emphasizes the value of using various logic flow diagrams (e.g., mind maps, dialogue maps, Dunker diagrams) as tools to encourage integrative, collaborative thinking during problem formulation and later stages of research.
- Dedicated funding and personnel for interdisciplinary research projects is acknowledged as necessary for successful implementation.
- The approach identifies newly available tools for data management, collection, and

synthesis, and recognizes these tools as being important for successful implementation of this approach.

- The model recognizes that communication at the beginning of a project among social and natural scientists is key to harmonizing their efforts.
- The model capitalizes on existing ACE natural science strengths while bringing new social science expertise to environmental problems associated with air pollutants, climate change, and energy extraction and use. This collaborative and interdisciplinary approach positions the ACE program to address a broad suite of environmental issues and to reach a larger and more diverse body of users. This approach provides a mechanism for bringing specific ACE program results (for example, small sensor data) to a wider audience, providing diverse applications with potentially significant public health benefits.
- The model codifies a process that can be followed by the ACE program and other groups to address an array of problems with an interdisciplinary approach. The team approach using interdisciplinary facilitation allows for multiple voices to be heard and builds consensus throughout the process. The process truly sets the stage for integrative science, and provides new opportunities for partnership and collaboration among social and natural scientists, including those inside and outside of the EPA. The ACE program staff will likely find these additional opportunities professionally and personally rewarding. At the same time, the document acknowledges that this new approach may be initially difficult for some staff to embrace, and hence the importance for incentives and rewards to encourage participation.

Weakness/suggestions: Some of the following points are not really weaknesses of the conceptual model, but suggestions for modification of the conceptual model to facilitate its application and usefulness.

- Strong leadership is needed at the problem formulation stage and beyond. Projects using this approach will need continuity and engagement from leaders throughout the process. Although the model recognizes the importance of a strong team facilitator to the success of interdisciplinary social-natural science projects (see strengths), it perhaps misses an opportunity to recommend early action to actively identify and develop within ORD a cadre of team facilitators (both social scientists and natural scientists) specifically trained to lead integrated social-natural science projects.
- Interdisciplinary collaboration becomes more facile when it is supported by administration, by an appropriately designed reward structure, and by reduced transaction costs (information costs, team building costs, etc.). As ACE begins to implement the model, more thought will have to be given to these issues.
- The conceptual model implementation describes building a large network, involving experts both within EPA and outside of EPA. The exact role of the network is not clear: Will they formulate the research questions and hypothesis? Will they also be part of the research team? ACE should clarify what the objectives and tasks of the network are, as well as incentives and rewards for people to participate.
- Model implementation needs to be an iterative process with built-in mechanisms for modification, evolution, and feedback throughout all stages of the project from conceptualization to completion. Feedback loops should be made more explicit in the existing description and implementation of the model.

- The model suggests many commendable recommendations in the text of the report, such as considering more flexible work space (p. 58) and considering development of a blanket purchase agreement for social science support (p. 59); however, the specifics are not captured in the conclusions and recommendations.
- The model does not address the trade-offs necessary to integrate the new elements with existing elements under flat or declining funding and other resource constraints.

Putting the model into practice will require a cultural change in how ACE research takes place. EPA should articulate how the change will occur, and consider using organizational change management to support its implementation plans. As acknowledged in the conceptual model, the interdisciplinary model approach will not be suitable for all applications in the ACE research program. It should be recognized that many ACE projects will continue as natural science/engineering research and that the interdisciplinary approach should not be force fit where it is not appropriate. Implementing it must be done with care to ensure resources, including personnel, in existing base programs are appropriately managed and retained. As the model is further developed, the Subcommittee requests clarification on the specific guidelines the agency will use to identify and select projects for the integrated social-natural science approach.

Charge Question 2

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

EPA has made a good start in piloting the social sciences conceptual model. Learning from these efforts can assist in establishing criteria for success moving forward. EPA might consider providing some criteria to assist in problem formulation development, which and serve as a guide for interdisciplinary social science research.

Some criteria that may be worth consideration in developing a problem statement include:

- magnitude of the problem (in terms of number of people impacted, area covered, hazard, risk)
- achievable benefits (health benefits, economic benefits, environmental benefits)
- resources, partnerships needed to complete interdisciplinary research project
- timeliness to completion and ability for research to contribute to solving problem
- level of community interest/engagement (is it an issue of critical important to the community?)

It will be useful to document the process and results of successful interdisciplinary projects in ways that inform problem formulation to address future research questions. Documenting lessons learned from the wildfire workshop as well as evaluating new tools deployed as a result of the workshop might be a good place to start. For example, in the wildfire workshop, one suggested outcome was the development and implementation of a smoke ready app that could be used to help protect the health of those who may live or work near wild fires through an early alert system and by sharing information on how members of the community can protect themselves. EPA could establish some metrics in advance of deploying the app to assess whether such an awareness campaign has achieved the goals of the interdisciplinary effort. Examples of metrics for the app might include number of downloads of the app, percentage of users over certain geographic areas that may be at increased risk for wildfires, and retention of users of the app. These indicators could serve as a measure for the effectiveness of a public awareness campaign focused on wildfires.

In addition, there may be more general ways in which EPA could maximize effectiveness in developing this conceptual model for interdisciplinary research, including:

- Selecting one staff member as the central point of contact to assist in project implementation;
- Putting together a list of resources (experts and documents, both internal and external from the agency) to draw from to conduct the research;

- Emphasizing follow-up activities to the workshops to ensure that the network of researchers remain active;
- Formally evaluating and assessing cross-programmatic workshops, with a particular focus on linking back to the goals and objectives of ACE/ORD. For instance, did the workshops contribute to the cultural change at ACE/ORD? How are ACE researchers involved? Will the workshop contribute to improved identification of the kind of social science capacity that is needed in the longer term, and how best to obtain that expertise?

Regarding potential applications in the climate domain, the 2016 Climate Roadmap assesses how EPA is currently or could in the future address the myriad ways in which climate change will impact EPA's mission to protect the environment and human health. Work on climate change impacts, adaptation, and mitigation all involve interactions between natural and human systems, and thus represent ideal settings for innovative natural/social science projects. We encourage EPA to develop additional pilot studies related to climate impacts, adaptation, and/or mitigation, and preferably involving two or more of these broad topics. In doing so, EPA may wish to identify areas in which EPA can have a unique role. Examples might include:

- quantifying mitigation/adaptation tradeoffs related to alternative transportation systems in cities that reduce both greenhouse gas and air pollution emissions, and encourage active transport such as biking or walking;
- investigating the benefits of urban greenspace for mitigation and adaptation, as well as health and wellbeing benefits;
- developing, applying and evaluating the value of downscaled climate and/or air quality projections for use by local decision makers, e.g., for planning related to disasters, water supply, land use, etc.;
- developing improved methods for assessing induced and/or avoided health impacts that result from mitigation and adaption actions (with emphasis on vulnerable communities);
- assessing the benefits/impacts of natural gas extraction, including fracking, relating to climate change, air quality, and health;
- assessing the potential for collaboration with other federal agencies that may be working on similar initiatives and collaborate when possible.

Enhancing the work of ACE by including more people trained and experienced with work on human dimensions of the applied research problems in the ACE portfolio will be more successful if intra- and extramural researchers perceive and gain the benefits of changing to a research approach with greater emphasis on social dimensions. Extramural researchers can be attracted to new or newly augmented funding programs that include integration of social science with traditional ACE research topics. As the research foci and funding sources and mechanisms change to incorporate these new social science elements, extramural researchers will likely adapt quickly.

Ensuring success of the augmented ACE research portfolio will also require direct involvement of intramural researchers. The draft roadmaps and piloted first versions of enhanced research projects shown to the ACE Subcommittee are excellent first steps. EPA has already begun a process to identify the knowledge, skills, and experience in ACE-related staff relevant to the new human and human population questions it will consider. This is a good development and should be expanded as quickly as possible using lessons learned from the wildfire workshop and the Cardiopulmonary Health Workshop to encourage existing staff to consider where and how their skills could fit into interdisciplinary social and natural science research projects.

Attracting and retaining intramural staff to this new model integrating natural and social sciences is the most crucial aspect of its successful implementation. However, this could significantly increase workloads for intramural staff still absorbing recent and continuing changes to science administration in ACE and ORD. EPA should consider new, augmented reward structures for joining integrated research teams. Similarly, new performance measures will be needed which augment (but not replace) the traditional emphasis on peer-reviewed papers in high-impact journals that has been a hallmark of ACE success over the years

The Subcommittee encourages EPA to carefully evaluate the trade-offs required to add and fund entirely novel aspects of social science and human population dimensions more generally to the continuing and future-planned applied physical and biological science, which is the hallmark of ACE research in support of EPA's missions. Adding staff who can expertly draft, execute, evaluate, and report on new social science research, in a time of flat and falling budgets and other research constraints, may require a reduction in the physical and biological science agendas and to the staff performing that work inside ACE and ORD. The Subcommittee recommends that ACE develop more explicit and formal estimates of the costs associated with shaping this change in direction and augmentation to ORD ACE research agendas and to existing and planned intramural ACE staff work. This information would allow a more direct cost vs. benefit analysis of implementing the new ACE vision.

Workshops may facilitate the change in culture. Having the opportunity for staff to present in both internal and external professional forums and brainstorm on current work would facilitate dissemination of information as well as generate new ideas. In addition, using community monitoring grants would provide a mechanism to collect information and engage with communities in real-time and provide a two-way communication opportunity to share insights about findings. In addition, community engagement has the added benefit of offering a way to promote and share research findings to the public at large, a key element to the success of an interdisciplinary program of this nature.

Charge Question 3

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

When social sciences are integrated into ACE projects, they must meet the same level of rigor as the natural sciences. In order to ensure that ACE supports high quality efforts, there is a need to develop metrics and expertise in reviewing the quality of social science research. One example is bringing in the expertise of other agencies like National Science Foundation (NSF) Social, Behavioral, and Economic Sciences Directorate to develop metrics and quality assurance (QA).

A major attribute of ACE scientists and engineers is their ability to address problems. Partnering at the problem formulation stage with the right team is important to help ACE researchers integrate the social sciences into new and existing programs. For example, problem formulation teams can include stakeholders and organizations that have experience with interdisciplinary team projects that examine the intersection of natural environments, built environments, and social systems. Potential partners will depend on the nature of the problem; some examples include:

- Nitrogen deposition from the air affects local watersheds and adds to the critical nitrogen load of an ecosystem; partners could include EPA's water and air program offices, state and municipal agencies, non-governmental organizations (NGOs), academia; individual with social science training should support the problem formulation process in terms of helping resolve conflicting goals.
- Acceptance of renewable energy in specific communities should involve collaboration between engineers who understand the technologies, behavioral economic criteria, the operation of local governments (this topic should be pursued in partnership with the Department of Energy).

ACE researchers should be incentivized to engage and present at interdisciplinary conferences. This might be achieved through publicizing a wider range of conferences within ACE and providing supplemental travel funds specifically targeted for staff participation at selected interdisciplinary conferences.

The Subcommittee also suggests that ACE hold regular interdisciplinary seminars organized around topics that are similar to projects or priorities in ACE, with a focus on bringing in project staff in addition to team leaders. ACE researchers would benefit from greater exposure to how interdisciplinary teams have solved problems.

Creative incentives for less formal collaborations with outside researchers in the social sciences would provide positive engagement for ACE researchers at relatively low or no additional cost and enhance their ability to tackle interdisciplinary problems. Examples might include:

- Running models with other researchers' data, leading to joint publications.
- Offering course credit for university students who carry out short-term collaborations with ACE researchers.
- Making use of current opportunities that engage graduate students and post-doctoral

researchers to explore interdisciplinary research problems.

- Targeting natural science and social science faculty and other non-academic experts to attend ACE workshops and possibly take on advisory roles.
- Becoming more familiar with interdisciplinary programs at other science-based federal agencies.

The conceptual model recognizes the value of early success. The Subcommittee encourages implementation of at least some elements of the conceptual model quickly to jump start the process. The example provided by the wildfire workshop is a good start to organize interdisciplinary teams involving ACE researchers and social scientists (either within or outside of EPA). It is important that ACE track and document activities associated with this initiative and evaluate performance for feedback and future improvement. Ideally, ACE can define where EPA can make a unique contribution to the challenges of interdisciplinary natural and social science research.

As projects are piloted within ACE (e.g., the wildfire workshop), the outcomes (what worked and what didn't work) should be communicated more broadly within ACE in an interactive workshop format.

The ACE Subcommittee also feels it is important to establish communication and expand existing networks to include:

- Training pre-college teachers in the importance of interdisciplinary projects, so that high school students are exposed to the concept of interdisciplinary approaches to environmental issues.
- Having discussions with other agencies, universities, and organizations that are good at supporting interdisciplinary collaboration.

Finally, interdisciplinary projects should be selected with care. ACE should avoid force fitting social scientists into purely natural science projects both to use funding wisely and to avoid the potential for failure.

Summary of Recommendations and Conclusions

Charge Question 1

The ACE Subcommittee applauds EPA for its innovative approach that is provided in the conceptual model: "Strengthening the Foundation for Interdisciplinary Social-Environmental Research in ACE." The application of this model entails an interdisciplinary approach that has broad implications and importance to the overall mission of EPA. The model provides new tools for addressing current and emerging environmental issues related to the air, climate and the extraction and use of energy. The application of the model should facilitate inclusion of a broader set of perspectives in addressing key environmental issues that include the participation of social and natural scientists and engineers. Recommendations for enhancing the application of this conceptual model include:

- Provide further specific examples of how the conceptual model will integrate social sciences into the ACE program and can be applied to other programmatic areas of the EPA;
- Detail some steps on how the ACE program will facilitate building networks of social and natural scientists and engineers, emphasizing how the program will develop strong leadership and integration among the disciplines related to the ACE program. Specify which approaches will be most important in enhancing the development of interdisciplinary research that addresses those environmental issues that are the core mission of EPA; and
- Clarify the importance of iterative steps that will be used to further refine the model application with respect to: problems to be addressed, methodology, data management, synthesis, and policy implications. Further indicate how the Agency will support cultural shifts within ACE and EPA more broadly for approaching environmental issues using this interdisciplinary approach. Describe how information from this approach extends beyond the Agency and hence encompasses a broad range of stake holders that are affected by environmental issues and policy.

Charge Question 2

EPA's piloting of the new conceptual model for incorporating social science into the ACE mission provides a valuable foundation for future expansion. EPA can build on lessons learned related to the process of problem formulation, outcomes, and evaluation. There are likely to be excellent opportunities for expansion in the domain of climate and air pollution impacts and adaptation research, and in applying environmental sensors to track and evaluate environmental change. To encourage buy in by both intramural and extramural staff and partners, it will be important to align incentives and performance evaluation structures. More broadly, EPA should carefully consider the costs and benefits of taking on new research priorities that may necessitate eliminating research in more the traditional environmental sciences.

The ACE subcommittee recommends the following:

- Develop guidelines for problem formulation and evaluation;
- Develop and apply new incentives and performance evaluation structures that align with the social science priorities of ACE; and
- Evaluate budgetary and staff tradeoffs related to making a shift towards more social science oriented research.

Charge Question 3

Partnering at the problem formulation stage with the right team is important to help ACE researchers integrate the social sciences into new and existing programs. Success in interdisciplinary team building rests on exposing ACE researchers to a broader range of areas of knowledge and approaches than they may have previously experienced. Furthermore, incorporation of metrics and expertise in reviewing the quality of social science research is critical to maintaining the high quality of work product for which ACE is known. When social sciences are integrated into ACE projects, they must meet the same level of rigor as the natural sciences. Finally, interdisciplinary projects should be selected with care. ACE should avoid force fitting social scientists into purely natural science projects both to use funding wisely and to avoid the potential for failure.

Therefore the committee recommends the following:

- Development of metrics for evaluating work in the social sciences can be supported by working with other government agencies that have previously developed methods for quality assurance of projects in the social sciences;
- ACE researchers should be incentivized to engage and present at interdisciplinary conferences. This might be achieved through publicizing a wider range of conferences within ACE and providing supplemental travel funds specifically targeted for staff participation at selected interdisciplinary conferences; and
- Creating new avenues (with appropriate incentives) for exposing ACE researchers to interdisciplinary projects such as conferences, in-house seminars, and less formal collaborations.

Attachment A

List of Materials

ACE BOSC Subcommittee Meeting

October 24-26, 2016

RTP, NC

Material Provided in Advance of the Meeting

- *Environmental Management* (EM) article titled "Human Problems Warrant Human Solutions: How EPA is integrating social and environmental science to help solve the most challenging and consequential problems related to air, climate, and energy"
- Paper titled "Strengthening the Foundation for Interdisciplinary Social Environmental Science in ACE"
- Executive Summary of the Paper titled "Strengthening the Foundation for Interdisciplinary Social Environmental Science in ACE"
- EHP Article (in review): "The Social Life of Sensors: Research Directions for Understanding Social Drivers and Impacts of the Use of Air Quality Sensors"
- DRAFT Climate Roadmap (FYI ONLY: this will be reviewed by the BOSC EC)
- DRAFT Climate Roadmap Annual Report (FYI ONLY: this will be reviewed by the BOSC EC)

Links to additional information:

- BOSC EC Report https://www.epa.gov/bosc/review-us-epa-office-research-and-developments-research-programs
- EPA response to the BOSC EC Report https://www.epa.gov/bosc/epa-response-review-office-research-and-developments-research-programs

Attachment B

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

Meeting Agenda – October 25-26, 2016
Research Triangle Park, North Carolina

TIME	TOPIC	PRESENTER
Tuesday, October 25, 2016		
8:00-8:30	Registration	
8:30-8:45	Welcome, Introduction, and Opening Remarks	Viney Aneja, Chair
8:45-9:00	DFO Welcome	Tim Benner
9:00-10:45	Program Update and Discussion	Dan Costa
10:45-11:00	Break	
11:00-11:30	Review of Charge Questions	Dan Costa Subcommittee
11:30-12:30	Lunch	
12:30-1:30	Presentation on ACE's conceptual model Discussion	Bryan Hubbell Subcommittee
1:30-2:30	Presentation on Smoke Communication Workshop Presentation on Cardiopulmonary Health Workshop Discussion	Bryan Hubbell Wayne Cascio Subcommittee
2:30-2:45	Break	
2:45-3:15	Presentation on Connections with SHC program Discussion	Andrew Geller Subcommittee
3:15-4:45	Discussion of Responses to Charge Questions	Subcommittee
4:45-5:00	Wrap-up and Adjourn	
Wednesday, October 26, 2016		
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
12:00-12:15	Wrap-up and Adjourn	