U.S. Environmental Protection Agency Board of Scientific Counselors

Air and Energy Subcommittee

Virtual Meeting Minutes

February 17-19, March 18, April 2, 2021

Dates and Times: February 17, 2021, 12:00 to 5:45 p.m.; February 18, 2021, 12:00 to 5:00 p.m.; February 19, 2021, 12:00 to 5:00 p.m.; March 18, 2021, 2:00 to 5:00 p.m.; April 2, 2021, 2:00 to 5:00 p.m. Eastern Time

Location: Virtual

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, the participants are listed in Appendix B, and the charge questions are provided in Appendix C.

Contents

Wednesday, February 17, 2021

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

Office of Research and Development Welcome

Jennifer Orme-Zavaleta, Principal Deputy Assistant Administrator for Science, Office of Research and Development

Dr. Jennifer Orme-Zavaleta welcomed the Board of Scientific Counselors (BOSC) Air and Energy (A-E) subcommittee members and participants to the virtual meeting.

Dr. Chris Frey appreciated the input of the participants as it is essential to the Environmental Protection Agency (EPA) and the Office of Research and Development (ORD). He stressed the importance that the NAAQS review focuses on identification and characterization of at-risk populations as there is more emphasis on the policy side with the new administration at EPA. Policy-relevant science is important for decision making. Scientists need to characterize issues for EPA to address cumulative exposures.

Dr. Orme-Zavaleta stated that ORD office buildings are open, and some researchers have been able to go in and continue work. The past year, the EPA Strategic Plan focused on the development of identifying problems and priorities for researchers to ensure the correct issues are being addressed. There is an increasing focus on ubiquitous contaminants.

Mr. Bart Croes asked whether Dr. Orme-Zavaleta had any insight into potential research budget or potential resources. Dr. Orme-Zavaleta responded that there has been proposed substantial budget reductions for research the past several years. Fortunately, Congress has kept ORD researchers stable for the past four years. Dr. Orme-Zavaleta cited that administration is working on a budget request for the fiscal year 2022. Dr. Orme-Zavaleta stated that a research budget has been sustained to support work in ORD, as well as other programs, for the current year. Despite budget cuts, Dr. Orme-Zavaleta ensured that ORD's work will continue to make an impact.

Ms. Sandy Smith inquired about ORD staffing needs. Dr. Orme-Zavaleta stated that ORD hired full-time employees and rebuilding the post-doc program. Dr. Orme-Zavaleta addressed ORD's vacancy of 100 full-time employees, stating a succession plan is being constructed to shape targeted areas for hiring.

Overview of Air and Energy Subcommittee Meeting Format and Charge Questions

Bryan Hubbell, National Program Director, Air and Energy Research Program

Dr. Bryan Hubbell introduced the A-E National Research Program staff. He appreciated the advice and recommendations from the BOSC A-E subcommittee and stated that they were implemented into the EPA Strategic Plan and developed Research Area implementation plans, which aid the process of researching data, models, and methods to deliver to partners. He reminded the group about the overall program structure including science of air quality decisions, extreme events and emerging risks, and next generation methods to improve public health and the environment. Implementation of research has been underway for two years. Dr. Hubbell discussed the structure and scope of the meeting and the charge questions that have been

developed. Dr. Hubbell highlighted the two focused areas to showcase the A-E program integrated and innovative approaches for addressing priority research needs:

1. Informing development, review, and attainment of NAAQS
2. Understanding health and ecological impacts of wildland fires to inform strategies aimed at decreasing negative impacts.

The above focus areas include research activities in Research Areas 1, 2, 3, 7, 8, and 9. The charge questions can be found in Appendix C.

Dr. Cascio addressed how EPA is researching COVID-19. EPA is highly engaged in supporting the response to the COVID-19 pandemic and efforts have been directed at detecting the virus and decontaminating surfaces. Dr. Cascio mentioned that there is research related to air quality. The virus is easily transmitted from person to person, likely from an aerosol route. The public health focus of the prevention has been wearing face coverings, staying 6 feet apart, and disinfecting. EPA pivoted in hopes that the research efforts would help to reduce the risk of SARS CoV-2. EPA studied how to disinfect PPE for reuse, what chemicals or technologies would eradicate the virus, and if textures on surfaces affect transmission.

Dr. Cascio described that under the leadership of Dr. Shawn Ryan, Homeland Security (HS) Research Program, and scientists in the Center for Environmental Solutions and Emergency Response (CESAR), EPA has been studying surface cleaning. Scientists in CESAR are additionally researching increased ventilation and air movement. State public health departments have been researching hotspots. Viral particles are present in feces and sewage of infected persons. Scientists in the Center for Environmental Measurement and Modeling (CEMM) have detected ways to discern changes in viral particle concentration in wastewater to monitor infection. Poor ventilation is another reason for risk of infection.

Dr. Cascio described a series of studies conducted by investigators at the EPA-funded University of North Carolina (UNC-EPA) Center for Environmental Medicine, Asthma, and Lung Biology in partnership with EPA scientists, Dr. James Samet and Dr. David Diaz-Sanchez. Coincidentally, Dr. Samet had initiated a study under the A-E program to investigate the use of N-95 respirators against the effects of wildfire smokes. The preparation for such study permitted EPA investigators to immediately address the filtration efficiency of various face masks during the COVID-19 pandemic.

Ms. Annette Rohr inquired about the collaboration between EPA and the Center for Disease Control (CDC), American Society of Heating, Refrigerating and Air Conditioning (ASHRAE), National Institute for Occupational Safety (NIOSH) and others in COVID-19 research. Dr. Cascio replied that the salivary antibody assay is being done independently, but information and samples shared. The work related to wastewater contamination is being conducted in collaboration with CDC. Dr. Cascio confirmed the collaboration with NIOSH and CDC in terms of respiratory research. ASHRAE has been focusing on guidance on wildfire smoke for their professional society.

Mr. Croes stated that the CDC does not have a lot of technical information on COVID-19, making it difficult to extract practical information to share with businesses. Mr. Croes asked

whether the EPA can share research in collaboration on their own. Dr. Cascio replied that EPA's role is to produce knowledge that others can use; EPA works in collaboration with CDC, who distributes the information. Dr. Cascio offered to send any of the several papers available containing such practical information.

Dr. Art Werner identified that information on transmission of aerosols was bleak initially and stated that people are staying six feet apart and wearing masks is acceptable. However, aerosols travel further than six feet. Dr. Werner inquired about virus transmission research from smaller particles that extend beyond six feet. Dr. Cascio replied that is the goal of EPA's current model.

Scientific Challenges and Key Uncertainties of National Ambient Air Quality Standards (NAAQS) Attainment (Charge Questions 1 and 2)

Bryan Hubbell, National Program Director, Air and Energy Research Program

Dr. Hubbell introduced the focus area as the science needed to support the NAAQS, which has made substantial progress in studying and obtaining those standards. He described considerable improvements on all the criteria pollutants directly associated with NAAQS. EPA's most recent NAAQS are from the EPA Our Nation's Air report. Improvements have largely been made from changes national regulations, state implementations, and vehicle technology. Despite the advances in setting and obtaining health standards, Dr. Hubbell stressed that not all sectors of pollutants have been equally addressed. He underscored that many of the areas of the country do not meet Our Nation's NAAQS.

Dr. Hubbell stated the A-E program does not set NAAQS but provides the foundation of scientific evidence and tools for their partners to set the standards and to determine how to meet them. He summarized the A-E program aims to improve air quality models to address complex atmospheric chemistry, topography, meteorology, and contributions from international transport and non-anthropogenic sources, as well as impacts of climate change, including increased temperatures, wildfire frequency and severity, and changes to the nation's electricity generation and transportation systems.

Dr. Hubbell stated that ORD scientists from CEMM and the Center for Public Health and Environmental Assessment (CPHEA) are addressing the scientific challenges.

Dr. Louis Rivers asked whether the graphic displaying the Distribution of Absolute Burdens of $PM_{2.5}$ Emissions from Nearby Facilities in the 2011 National Emissions Inventory, Stratified by Race/Ethnicity and Poverty Status included income with the race information. Dr. Hubbell will verify.

Approaches for Addressing Scientific Challenges and Key Uncertainties of National Ambient Air Quality Standards (NAAQS) Attainment (Charge Questions 1 and 2)

Tim Watkins, Center Director, Center for Environmental Measurement and Modeling

Mr. Tim Watkins provided information and context to research implementation. He presented a 2004 report by National Academy of Sciences (NAS) on the cycle of setting standards, designing, and implementing control strategies, and assessing status and measuring progress.

Mr. Watkins discussed new and emerging scientific uncertainties, as well as complex and evolving scientific challenges. He discussed how air pollution continues to present impacts on publish and environmental health and changes and identified challenges to research implementation, including complex nonattainment areas, changing technology and data access.

Mr. Watkins provided a high-level overview of the A-E Research Areas 1-8. Mr. Watkins asked for suggestions or recommendations from the A-E subcommittee regarding progress to date of A-E research activities, as well as suggestions to enhance implementation.

Dr. Jennifer Hains asked about the definition of sensitive populations and how the definition changes. Mr. Watkins responded that based on environmental justice (EJ) concerns, the definition can broaden (i.e., sensitive, at-risk, vulnerable). Dr. Hubbell stated environmental racism may contribute to the factors that EPA identifies as effecting vulnerability.

Research to Inform Decision Making and Plans to Meet National Ambient Air Quality Standards

Tiffany Yelverton, Principal Investigator – Assistant Center Director, Center for Environmental Measurement and Modeling

Dr. Tiffany Yelverton introduced the panelists and panel discussion topics.

Empirical and Computational Approaches to Inform National Ambient Air Quality Standards Compliance

Alan Vette, Atmospheric and Environmental Systems Modeling Division Director, Center for Environmental Measurement and Modeling

Dr. Alan Vette, Deputy National Program Director, provided an overview of the ongoing research products focused on localized issues. He stated the nature of air pollution has changed in the last 20 years and localized solutions and applications are necessary to address underlying issues. He discussed the $PM_{2.5}$ nonattainment issue in Fairbanks, Alaska as an illustrative example on how local nonattainment presents unique process and modeling challenges due to a combination of unique emission sources, meteorological conditions, geographical features, and/or non-controllable sources. He described that collaboration with EPA Region 10, the state of Alaska, and academics.

Dr. Vette introduced the Long Island Sound Tropospheric Ozone Study (LISTOS). He described that in partnership with NASA, they are placing Pandoras, sun tracking UV/Visible spectrometers, at air monitoring sites under the Photochemical Assessment Monitoring Stations network. The study goal is to understand ozone production within the New York and Connecticut region. Dr. Vette further described the LISTOS Modeling Approach.

Dr. Vette discussed efforts on discerning chemical mechanisms and kinetics. He showed an image of the atmospheric chemistry chamber used to simulate atmosphere compositions. He stated that they have focused on secondary organic aerosol (SOA) formation. The chemistry chamber can also be used to identify specific tracers that are indicative of specific precursors. Dr. Vette stated that this work is being done in conjunction with the STAR grant on chemical mechanisms.

Dr. Vette explained that outside of the laboratory, they can look at computation quantum chemistry. These approaches can be used to gain insight and for reactions for which it would otherwise be difficult to do experiments. He stated that machine learning approaches have powerful capabilities and are being used to make improvements to model parameters and understanding of the parameters.

Dr. Vette discussed expansion to the SPECIATE 5.1 Database to provide gas and PM speciated emissions profiles. The product is cumulative which is critical for air quality monitoring and applications.

Dr. Vette provided an overview of the National Air Emissions Monitoring Study (NAEMS), a two-year industry-funded study. He stated the fundamental purpose is to develop methodologies to use to estimate emissions from agricultural operations.

Dr. Vette illustrated the importance of land use specific deposition by comparing it to grid cell average deposition to provide a better understanding of deposition factors across a watershed and nutrient load to a bay.

Dr. Vette explained the need to quantify natural contributions to anthropogenic enhancements. Dr. Vette briefly discussed examples and focus towards updating standards to place greater emphasis on the ability of models to predict non-anthropogenic enhancements. Dr. Vette mentioned developments towards advanced air quality modeling systems, as well as energy modeling. He stated that these are used to discern the impacts and benefits towards NAAQS to look towards the future.

Dr. Constance Senior asked about the A-E program's process for determining which areas are most important when studying local nonattainment areas and whether the vulnerability of the population in those areas are known. Dr. Vette explained the case of Fairbanks, AK was important to EPA Region 10, as is any case from the EPA regions. EPA has the tools and interest to pursue cases brought to them. With the LISTOS study, an enormous population was impacted by ozone levels.

Dr. Senior asked about the critical gaps in Community Multiscale Air Quality (CMAQ) modeling system, in terms of chemical mechanisms. Dr. Vette responded that any chemical mechanism is an abbreviation to speed up computational time, but some mechanisms are developed with the consideration of ozone formation.

Mr. Croes asked for detail on the trends presented by Dr. Hubbell. Dr. Vette stated that there have certainly been flat trends in terms of ozone and $PM_{2.5}$. He knows that emissions have been decreasing for both. Solvent replacement technologies have been in place to reduce emissions of toxins.

Measurement Research to Inform National Ambient Air Quality Standards Decisions

Lara Phelps, Director, Air Methods and Characterization Division, Center for Environmental Measurement and Modeling

Ms. Lara Phelps provided an overview of the research work the Air Methods and Characterization Division (AMCD) and the tools being used to measure and characterize

NAAQS and other pollutants. Ms. Phelps described that AMCD interfaces with all ORD centers in addition to EPA Program and Regional offices, state/local agencies, academia, industry, communities, and other federal and non-federal organizations relative to Division programs and services.

Ms. Phelps described research on Federal Reference Methods (FRMs) and Federal Equivalency Methods (FEMs), which fosters newer technologies that helps us meet the needs of the public and health advisory individuals. This has been considered the gold standards of air monitors by government regulatory programs, instrument manufacturers, air quality researchers, health scientists, and the public.

Ms. Phelps described the complementary role of air sensors which provide high quality data to help assess the public's exposure to criteria pollutants and for evaluating the effectiveness of pollutant control strategies. She emphasized a desire for measurements that can be used in a temporary location, passive sampling, or handheld. The regulatory network is used for regulatory purposes, and the sensors for non-regulatory purposes. She stated that data from regulatory systems is used for compliance decisions, and in the sensors is used for informational purposes. She highlighted several differences about data and briefly discussed the application program in output 7.1, Product 7.1.2.

Ms. Cara Keslar asked about work in the sensor area outside of ozone and $PM_{2.5}$. Ms. Phelps stated there are several sensors, but not as far along as $PM_{2.5}$ and ozone sensors, which are under evaluation.

Welcome and Opening Remarks

Tom Tracy, Designated Federal Officer, Office of Science Advisor, Policy, and Engagement
Charlette Geffen, Chair
Sandy Smith, Vice Chair

Mr. Tom Tracy, Designated Federal Officer (DFO) for the U.S. EPA BOSC A-E subcommittee and thanked the participants for their attendance. He made brief announcements regarding virtual meeting capabilities and reminders.

Dr. Geffen welcomed the participants and gave a brief overview of the meeting agenda. The BOSC A-E subcommittee members introduced themselves.

Insights from Partners/Users of Air and Energy Research

Kathryn Sargeant, Deputy Director, Benefits and Air Toxics Center, Office of Air and Radiation

Chet Wayland, Office of Air and Radiation

Ms. Kathryn Sargeant highlighted the research on understanding the localized impacts of transportation sources which is critically important to efforts to protect public health due to the large population localized around transportation sources. Ms. Sargeant described the partnership between ORD and the Office of Air and Radiation (OAR to characterize near-road environment, identify mitigation options, measure their impacts, and model near-road environment. She described ORD's continued progress on mitigation options such as vegetation barriers.

Ms. Sargeant outlined the key link needed to inform decisions by states and communities is the ability to model the localized air quality impacts of the design options. She stated that federal regulations are in place to govern the transportation planning process, emphasizing that the OAR transportation impacts cannot be considered unless there is a way to model and subsequently quantify. She identified that ORD's recent work in partnership with OAR is to provide the analytical tools that are the critical bridge between identifying and measuring mitigation measures to facilitating their practical consideration and adoption. She emphasized that the work has attracted additional resources from the State Department of Transportation and the Federal Highway Administration.

Ms. Sargeant highlighted OAR's recent work on the characterization of air quality near ports and railyards and community impacts. She emphasized that ORD's work and railyards and reduction of freight movement is a key priority for EJ.

Dr. Chet Wayland discussed EPA's AirMod model and research on barriers and roadways. Dr. Wayland emphasized how this work ensures the methods meet EPA's standards.

Considerations to Maximize Public Health Benefits (Charge Question 2, Research Areas 3 and 8)

Tom Long, Physical Scientist, Center for Public Health and Environmental Assessment

Dr. Tom Long introduced the panelists.

Health Effects

David Diaz-Sanchez, Center for Public Health and Environmental Assessment

Dr. David Diaz-Sanchez provided an overview of the assay to outreach approach. These assays are confirmed in clinical and population-based studies that link environmental conditions to health. He explained how the results inform public heath outreach programs to reduce the risk of environmental exposures. He emphasized that this all-encompassing approach is used by the Center for Public Health and Environmental Assessment (CPHEA) in its health effects research studies.

Dr. Diaz-Sanchez explained CPHEA's focus on examining the health outcomes of exposure to NAAQS pollutants. He mentioned EPA's Human Studies Inhalation Facility, a state-of-the-art facility to model exposures and look at differences between exposure media. The aim of the is to study biological changes from exposure and then extrapolate the research to a population-based study. Dr. Diaz-Sanchez emphasized the findings of a recent study which found that low levels of $PM_{2.5}$ increase vascular damage and reduce pulmonary function in young healthy adults. noting that even low levels of $PM_{2.5}$ resulted in adverse health effects. He hopes that the study findings can soon be extrapolated to high-risk populations.

Dr. Diaz-Sanchez emphasized CPHEA's in-vivo program which has capability to research physiochemical components in exposure sources. Dr. Diaz-Sanchez discussed the photochemical smog chamber which can create artificial atmospheres to emulate place-based research studies, as different atmospheres based in distinct parts of the country can be modeled with the chamber.

Dr. Diaz-Sanchez noted CPHEA's research into the interaction between temperature, pollutants, and health outcomes. He emphasized that CPHEA researches environmental health disparities that exist in at-risk populations and discussed findings that low-level ozone has both respiratory and systemic effects in African American youth with asthma despite asthma controller therapy.

Dr. Diaz-Sanchez mentioned CPHEA research on air pollution's role in changing the epigenome, such as the idea of the epigenome as a biosensor for pollution. He mentioned that CPHEA is evaluating public health strategies to mitigate the risk from pollutants. These strategies include policy, diet, avoidance, and communication.

Dr. Hains complimented Dr. Diaz-Sanchez on his research and noted that a lot of the mitigation strategies for pollution risks are personal based. She asked if there are ways to mitigate from a community perspective instead of an individual level. Dr. Hubbell replied that the A-E program is conducting research on community clean air spaces that can provide a safer place for community residents who do not have access to air filters during high PM events, such as during wildfire smoke events. Those studies will be discussed later in the meeting.

Air Pollution Exposure

Lisa Baxter, Center for Public Health and Environmental Assessment

Dr. Lisa Baxter emphasized that CPHEA's Public Health and Environmental Systems Division (PHESD) possesses multiple areas of expertise to perform air pollution exposure, including environmental pathways and modeling, epidemiology, and exposure indicators.

Dr. Baxter outlined the variety of ways that PHESD supports the NAAQS pollutants. She stated that PHESD is looking to improve data analysis and modeling of near-road exposures. She stated that the results will improve approaches to inform NAAQS attainment issues and the use of monitoring site data to represent near-road exposures.

Dr. Baxter provided two examples of population-based epidemiological studies being done by PHESD. One study examined spatial determinants of mortality related to $PM_{2.5}$ mass distribution, sources, and composition. The other study looked at the correlation between air pollution and out of hospital premature deaths in rural eastern North Carolina communities.

Dr. Baxter discussed a comprehensive study of the impacts of wildfires on drinking water. She emphasized that this vulnerability assessment will help in locating watersheds for modelling nutrient and chemical mobilization and movement following fires, to inform OW staff and regions of the drinking water systems vulnerable to perturbances by wildfires.

Insights from Partners

Rona Birnbaum, Chief, Climate Science and Impacts Branch, Office of Air and Radiation
Erika Sasser, Director, Health and Environmental Impacts Division, Office of Air and Radiation

Dr. Rona Birnbaum acknowledged the strong relationship between OAR and the A-E program. She noted the overall support for the collaboration from both programs is tremendous and stated examples of this collaboration include the work in using meteorological data to advance the FLUX model and improving SOPs for low-cost measurement systems. Additionally, the A-E

program has provided the Consequence Management Advisory Team (CMAT) time series to inform deposition models.

Dr. Birnbaum emphasized the A-E program's role in the 2016 reports about climate and health. She noted the A-E program will have a greater impact in report development in the future, particularly in reports detailing the interaction between climate change, air quality, and health impacts.

Dr. Birnbaum stated the A-E program has filled key research gaps, including the study of at-risk populations. OAR continues to be impressed with the research coming out of STAR grants within the A-E program.

Dr. Erika Sasser stated the broad A-E program research portfolio intersects with OAR's work, including the foundational health effects research that directly informs OAR reviews and models for air quality improvements.

Dr. Sasser noted that the A-E program provides scientific insight on effective ways to communicate exposures, such as wildfire smoke exposure communication, which is important to interactions with the regions, states, localities, and tribes.

Meet the Scientists:

Room A

Air Quality Modeling, Session-Lead

Rohit Mathur, Senior Scientist, Center for Environmental Measurement and Modeling

Dr. Rohit Mathur described the session's goal to provide three examples of research that embody robust comprehensive modeling tools and data sets that collectively help address emerging issues related to air quality.

Community Multiscale Air Quality (CMAQ) Modeling System

Christian Hogrefe, Research Physical Scientist, Center for Environmental Measurement and Modeling

Dr. Christian Hogrefe discussed the Community Multiscale Air Quality (CMAQ), study interactions, autoxidation, public messaging around preventative strategies, and modeling.

Designing an Air Quality Monitoring System for the Future

Luke Valin, Center for Environmental Measurement and Modeling, Long Island Sound Tropospheric Ozone Study (LISTOS)

Dr. Luke Valin described LISTOS's focus on designing air quality monitoring systems to categorize complex phenomenon and providing important data to ground truth models. Subcommittee members asked about model nonattainment, toxic load of non-atmospheric chemicals, and per- and polyfluoroalkyl substances (PFAS).

Understanding the Implications of Volatile Chemical Products (VCPs) on Public Health

Havala Pye, Physical Scientist, Center for Environmental Measurement and Modeling

Dr. Havala Pye discussed resources**,** external collaboration, state, and local monitoring air networks, salinometer work, and ethanol emissions.

Session 1 Q&A:

Dr. Geffen inquired as to what extent there is interaction or engagement with scientists looking at SOA formation or process studies.

Dr. Mathur replied that most interactions with Pacific Northwest National Laboratory (PNNL) are informal. Dr Pye added that CEMM's work in 2019 used data from PNNL chambers. CEMM is still working on getting the data into CMAQ.

Dr. Hains asked about the public messaging around preventative strategies of VCP hand-to-mouth exposure from a public health standpoint. Dr. Pye stated that public messaging has been highly focused on the inhalation route. Other routes of exposure have proved non-important from data gathered. Dr. Pye discussed the factor of age and messaging could be shifted to ingestion if they were to target adults vs. children. Dr. Hains inquired whether the effects of VCP from other routes are negligible or if they do not know that information yet. Dr. Pye stated that research is ongoing and chemical safety has been focused on upper-level exposures.

Dr. Geffen asked about the extent of the LISTOS study and whether CEMM plans to take the data to a regional or larger scale. Dr. Valin replied that they are looking at meteorology and how the high-pressure systems and winds set up for a local flow dynamic.

Session 2 Q&A:

Dr. Senior asked if the CMAQ model can model non-attainment areas accurately in terms of resolution and scale. Dr. Mathur replied that CMAQ is used to model nonattainment areas. In many cases, that does require modeling at high resolutions to address issues of nonattainment areas. Dr. Jon Pleim added that LISTOS is a particular nonattainment issue in Long Island that has a very local meteorological component.

Dr. Hazel Gordon stated that the EPA appears to have a robust research effort to assess PFAS in our environments. She asked whether Dr. Weaver's work includes toxic load of non-atmospheric chemicals on individuals.

Session 3 Q&A:

Ms. Smith asked the three session leads if they could each acquire one thing (expertise, resource, equipment, collaboration, etc.) what would you wish for that would enable you to do your job better. Dr. Hogrefe replied that he would appreciate more full-time employees. He mentioned that external collaborations are important, but collaboration is a bit less of a priority if full-time employees are in place. Dr. Valin stated that he would have state and local air monitoring networks in place. Implementing the data into the modeling world would be the priority. Dr. Pye agreed full-time employees are beneficial.

Ms. Keslar asked whether the salinometer work network was used during the wildfire season. She identified the problem predicting where smoke is going out West. Dr. Valin replied that network was used and use of the salinometer in such capacity would be of interest.

Ms. Keslar asked about the emissions regarding the VCP from oil and gas operations. Dr. Pye replied it is ethanol emissions. She stated that the 2021 National Emissions Inventory would

include ethanol in their estimates. Ms. Keslar and Dr. Pye discussed sharing information regarding Title 5 facilities.

Room B

Health Effects, Session-Lead

Ian Gilmour, Center for Public Health and Environmental Assessment

Dr. Ian Gilmour introduced the scientists and discussed their presentations.

Electronic Health Records

Cavin Ward-Caviness, Computational Biologist, Center for Public Health and Environmental Assessment

Dr. Cavin Ward-Caviness described EPA CARES, a resource of several million University of North Carolina electronic health records, and the exploration of environmental health using the deep clinical phenotyping and sample size of electronic health records. These electronic health records greatly advance EPA's ability to perform key epidemiological research studies. Additionally, Dr. Ward-Caviness emphasized that the creation and analysis of these electronic health records revealed vulnerable patient populations and how air quality affects them.

Epidemiology to Identify Environmental Justice Issues

Anne Weaver, Population Health Data Scientist, Center for Public Health and Environmental Assessment

Dr. Anne Weaver described her research into how area-level socioeconomic status (SES) affects health outcomes such as obesity, diabetes, and hypertension. She noted that area-level SES effects are also associated with air pollution, as lower-SES urban communities tend to be more polluted. Dr. Weaver said the key research question is: are health effects from air pollution different based on area of residence?

This research is currently being conducted in three counties in the Research Triangle area of North Carolina. Dr. Weaver explained that they found stronger associations between $PM_{2.5}$ and hypertension in neighborhoods that were urban, low-SES, and had a large Black population. Further research will expand to other areas and focus research on under-represented populations, such as American Indians.

Air Pollution Toxicology

Mehdi Hazari, Physiologist, Center for Public Health and Environmental Assessment

Dr. Mehdi Hazari explained his research focuses on using animal toxicology to understand health effects, mechanisms, and modifying factors of air pollution. He provided findings from the research demonstrating that intermittent noise exposure increases triggered cardiac arrhythmia after ozone exposure and depleted housing causes higher heart rate after smoke exposure and increased anxiety.

Session 1 Q&A:

Ms. Keslar asked the investigators how their research is transmitted to OAQPS to be used for setting the NAAQS. Dr. Gilmore answered that the research is published in open literature and picked up by air quality assessments. He elaborated that they produced the integrated science assessments which are the documents for the OAR. Dr. Weaver added that they meet quarterly with different divisions to figure out where the gaps are in research and understanding.

Ms. Smith asked the investigators what would make their job easier. Dr. Ward-Caviness replied more trainees to push the cause forward. Dr. Weaver replied she would appreciate resources to perform in-depth epidemiology research to gather intensive data of health and psychology measurements. Dr. Hazari would remove some of the bureaucratic red tape to reduce the paperwork.

Session 2 Q&A:

Dr. Geffen asked Dr. Hazari to confirm the time of exposure and his thoughts on thresholds of exposure. Dr. Gilmore explained that certainly they are observing exposure research as it relates to gas phase or particulate phase.

Session 3 Q&A:

Dr. Jeffery Arnold thanked the investigators and asked to what extent the research priorities are coordinated with the measurement or modeling folks could represent the exposure and effect side. Dr. Gilmore commented on the field work with monitoring staff and the direct link to the CMAQ and other modeling staff. Dr. Ward-Caviness added that he is working with the CMAQ team and has noticed that CMAQ models have advanced substantially and greatly benefited his health effect research.

Dr. Arnold commented on the grid scale which have rarely proven helpful for health effect research. Dr. Ward-Caviness explained that CMAQ has advanced to aid his research.

Room C

Deposition, Session-Lead

Donna Schwede, Physical Scientist, Center for Environmental Measurement and Modeling

Dr. Donna Schwede introduced the speakers.

Measurements

John Walker, Physical Scientist, Center for Environmental Measurement and Modeling

Dr. John Walker presented content on work product 3.6.1. He focused on reactive Nitrogen deposition from a measurement standpoint focusing on dry deposition methodologies. He also presented current examples and methodologies such as the COnditional-Time Averaged Gradient (COTAG) System.

Environmental Protection Agency's Air Quality Time Series Project (EQUATES)

Kristen Foley, Statistician, Center for Environmental Measurement and Modeling

Dr. Kristen Foley discussed EQUATES – EPA's Air QUAlity TimE Series Project, a collaborative project across ORD/CEMM, OAR/Office of Air Quality Planning and Standards (OAQPS), and OAR/Office of Transportation and Air Quality (OTAQ). This project adds to other modelling systems by making improvements to the temporal coverage, spatial domains, meteorological inputs, emissions inputs, and by using the latest version of EPA's Community Multiscale Air Quality Model (CMAQ) to simulate long term depositions more effectively.

Critical Loads

Chris Clark, Research Scientist, Center for Public Health and Environmental Assessment

Dr. Chris Clark reviewed the definition of critical loads and reviewed findings and research based off the work that comes out of the previous presentations in this session. Major findings included that not all ecosystems are equally vulnerable to atmospheric deposition of nitrogen and sulfur, the quantification of critical loads for forest and grassland ecosystems in the U.S. and discussed specific concerns and predicted trends in deposition.

Discussion

Session 1 discussion topics included EQUATES domains with CMAQ and the continental U.S. (Conus), emissions exchange with Environment Canada, Sulfur deposition, and reactive nitrogen deposition. Session 2 discussion topics focused on eutrophication, atmospheric deposition, and mercury deposition. Subcommittee members asked about federal reference methods for ammonia, estimates of critical load impacts, and predicted climate change effects. Session 3 discussion topics included precipitation confounding factors, sulfur and nitrogen deposition, farmlands and bidirectional flux of ammonia, and biogeochemical data.

Session 1 Q&A:

Dr. Arnold inquired about the EQUATES and CMAQ mapping. Regarding the large domain for the Northern Hemisphere, he asked if there were plans to create smaller subdomains outside of the Conus. Dr. Foley responded that the only 12km subdomain will be the Conus.

Dr. Arnold noted that part of the problem in doing anything outside the Conus is figuring out how and what are the subdomains. He asked how much better the emissions for the rest of the Northern Hemisphere are compared to the past. Dr. Foley responded that updates have been made for the Northern Hemisphere and an emissions exchange is happening with Canada. The goal is to create a consistent set of emissions for the Northern Hemisphere.

Dr. Walker and Dr. Clark explained there are multiple species of nitrogen in the atmosphere. He asked if they are only computing total nitrogen deposition or nitrogen deposition for individual species. Dr. Clark answered that historically they have computed for total nitrogen deposition but moving forward would like to compute for individual species. He added that there are limitations that make doing so difficult. Dr. Walker added that from the modeling side, the goal is to create a total nitrogen deposition budget to understand the species contributing the most to the increase in total nitrogen deposition. Both investigators mentioned that they cannot comment on the levels of ammonia.

Session 2 Q&A:

Dr. Weaver asked what percentage of this nitrogen deposition comes from fertilizer runoffs and other things versus atmospheric deposition. Dr. Clark responded that there is a lot of variation.

Dr. Weaver inquired where they are on developing a federal reference method for ammonia. Dr. Walker answered that there is not currently method to develop a reference method for ammonia. He mentioned that the methods range from passive measurements and time integrated measurements that vary in time resolution. He stressed that a collective effort from instrument companies have not been made to develop an inlet that minimizes ammonia losses and aerosol volatility that can interface with a standard method for measuring ammonia. Until this can happen, he underscored that they are limited in developing a federal reference method. Dr. Weaver asked whether EPA could take the lead on developing the inlet Dr. Walker described. Dr. Walker answered that EPA could eventually, but this is not a current focus.

A subcommittee member expressed curiosity over whether there are resources, or the investigators know how the mercury deposition network could be used or any studies present that use the deposition data. Dr. Schwede replied that there is a new effort to look at the mercury deposition data to investigate how measurements and modeling can be improved in mercury. She mentioned that the National Atmospheric Deposition Program (NADP) has a new committee called Mercury in the Environment and Links to Deposition (MELD) focused on mercury deposition. This has not been an area of focus for A-E research, but the CMAQ model has the capacity to model mercury.

Dr. Smith asked the investigators to identify a resource that would aid their efforts. Dr. Walker stated the need for improved deposition budgets and reducing uncertainties in atmospheric deposition. He added that long term data would substantially aid the understanding of deposition. Dr. Clark asked for two statisticians and one biogeochemist modeler. Dr. Foley added she would wish for additional CMAQ team members.

Session 3 Q&A:

Dr. Geffen asked Dr. Clark to elaborate on the effect of different levels of precept in the uptake from the whole plant system and whether they observe the tipping/trade off points and at what stage will there be a shift in climate changes in different environments. Dr. Clark responded that all the models they use include climate factors. He stated that long term, they would like to build in the plant interactions with the models. Dr. Clark addressed incorporation of the variability of plant species into the critical loads.

A subcommittee member commented on the huge shift in nitrogen and sulfur deposition since the 1990s and asked about the is deposition impacts are still bad enough to justify lowering the second standard. Dr. Clark stated if the goal is to avoid any adverse effect, then there is justification of lowering the standard, adding that the answer is complicated.

A subcommittee member asked whether Dr. Walker participated in research in agriculture. Dr. Walker replied that the levels must be much higher than they are to have a severe ecological consequence on crops.

Dr. Walker discussed how they are using biogeochemistry data to drive models of bidirectional surface exchange of ammonia. As such, his research considers differences in agricultural and natural systems in terms of levels and types of nitrogen in modeling air levels and surface exchange of ammonia.

BOSC Subcommittee Questions and Answers

Charlette Geffen, Chair
Sandy Smith, Vice Chair

Dr. Geffen moderated the subcommittee discussion, which included modeling outputs, wildfire emissions, and identifying vulnerable populations in communities.

Dr. Michael Kleinman asked in which ways the A-E program incorporating wildfire information into model outputs. Dr. Hubbell responded that aspect of wildfires will be discussed at the next meeting.

Dr. Arnold inquired how the A-E program develops research to address problems that were not defined by the previous administration. Dr. Hubbell replied that the A-E program is working towards anticipating future and near-term programs for the new administration.

Ms. Smith asked if there any specific programs or concepts should be de-emphasized within the A-E program. Dr. Hubbell stated that two adjustments were made. A few clinical studies were dropped due to the COVID-19 pandemic. He noted most of the A-E program work was pushed back rather than dropped entirely.

Dr. Rivers addressed identification of vulnerable or sensitive groups, whether the A-E program is doing so and if doing so changes their research. Dr. Hubbell confirmed the A-E program engages with these communities.

Closed Session for BOSC Subcommittee Discussion

Dr. Senior questioned how A-E program work is done to address the charge questions. Dr. Kleinman agreed stating an example that wildland fires research is looked at as a separate issue and no strategy has been addressed to incorporating the research into the NAAQS.

Dr. Rohr recommended a checklist of all the completed projects for the subcommittee to track. Ms. Smith stated that the A-E program did provide the subcommittee a list of their products related to each charge, but the projects are not marked completed. Dr. Mitchell emphasized that the A-E program should compile their research projects together, specifically the intra-agency work.

Adjourn

The meeting adjourned at 6:45 p.m., Eastern Time

Thursday, February 18, 2021

Welcome – Day 2

The meeting reconvened at approximately 12:00 p.m., Eastern Time

Welcome and Opening Remarks

Tom Tracy, Designated Federal Officer, Office of Science Advisor, Policy, and Engagement
Charlette Geffen, Chair
Sandy Smith, Vice Chair

Dr. Geffen welcomed the participants and reviewed logistics. She thanked Dr. Hubbell and his team for their continued participation and conversations.

Current Challenges posed by Wildfires

Bryan Hubbell, National Program Director, Air and Energy Research Program

Dr. Hubbell gave an overview of the presentations on health and environmental impacts associated with wildfires. He emphasized the motivation for this research is the impact on air quality and human health, water quality and quantity, ecosystems and habitats, and climates. Dr. Hubbell addressed the incorporation of climate changes for both current and future impacts. He gave an overview of wildland fire impacts on human health and water. He stated that Charge Question 3 will be the focus for today's panel discussions.

Dr. Geffen noted that she is pleased to hear about how the A-E program is addressing the social science and systems approach to the research efforts.

Dr. Aneja mentioned how Dr. Hubbell indicated that climate change is increasing the acreage burned, not the number of fires every year. He followed that climate change is an averaged information on temperature and other parameters. Dr. Hubbell replied that they do not know if climate change is directly affecting some parameters. This past year, California fires started by lightning strikes. As such, Dr. Hubbell stated how they count fires still has surrounding questions.

Dr. Aneja propositioned fires could be due to the fuel in the region that is burning up and may not have anything to do with climate change. Dr. Hubbell stated that they predicted the acreage burned before and after climate change. The goal of ORD's research is not to project the number of fires, rather look at the smoke implications of the fires. Climate products produced by others are being used to do so. Mr. Darrell Winner stated that a clear trend in the data has been discerned.

Ms. Smith asked whether masks help in terms of social science inhalation. She inquired whether the current population is more accommodated to wearing masks. Dr. Hubbell responded that masks help and mentioned the ongoing work about various characteristics of mask use and investigating the efficacy of masks.

Dr. Tom Long replied that ORD is preparing to do a face mask study that investigates the effects of mask wearing and fit, but the study was put on hold due to COVID-19. Dr. Long noted that the smoke aspect of this study will continue once they can get back to the lab.

Mr. Croes asked whether there are plans to revise ORD's wildfire smoke guidance. Dr. Hubbell will get back with more information. Mr. Croes stated the Purple Air website was the easiest platform to navigate during the California fires the summer of 2020. Dr. Hubbell followed confirmed receipt of similar feedback from several other states.

Dr. Arnold cautioned the Program on discussing the direct connection between climate change and the number of fires or hurricanes.

Approaches to Address Current Challenges Posed by Wildfires

David Diaz-Sanchez, Center Director, Center for Public Health and Environmental Assessment

Dr. Diaz-Sanchez provided an overview of the foundation ORD gives EPA to execute a mandate to protect human health and the environment. He discussed the integrated approach used in research to understand fire emission impacts, providing details of the respirator/face mask study conducted by EPA in 2021. EPA is testing the effectiveness of a range of devices, including NISOH approved N95 or P100 respirators and surgical masks.

He reviewed the targeted research questions, study components, and partners of the Wildfire study to Advance Science Partnerships for Indoor Reductions of Smoke Exposures (ASPIRE) included in the research.

Ms. Rohr identified that some variables in the community health vulnerability index have overlap. She inquired as to what is the resolution of the tool. Dr. Diaz-Sanchez stated that resolution can only be a good as the input, which is typically census data. He emphasized that the limiting factor is not the exposure, but the demographic data.

Dr. Hains asked about the strategy for outreach regarding vulnerable communities. Dr. Diaz-Sanchez responded the CPHEA is meeting with their partners and individual representatives. The Smoke Sense application has a strong communication team trying to expand to at-risk populations. He noted difficulties in targeting vulnerable populations. One strategy is to educate the clinical system to talk with their patients. Dr. Diaz-Sanchez mentioned Dr. Cascio's course for health impacts on PM smoke. Dr. Hubbell emphasized ORD's is active in sharing information with other agencies.

Dr. Hains inquired how public comments from the community were incorporated into the research strategy. Dr. Hubbell stated EPA conducts listening sessions with states and tribes about their experiences and questions. He emphasized that there is a great deal of feedback on EPA's and the experiences of these individuals.

Dr. Rivers addressed the limitation about resources and opportunities, and the opportunity to integrate the social science. Dr. Rivers underscored the importance and type of communication for vulnerable populations. Dr. Diaz-Sanchez agreed and stated that Dr. Hubbell has championed the integration of social science into the program. Dr. Hubbell recognized the different populations and discussed the focus on creative intervention strategies to connect with vulnerable populations.

Dr. Myron Mitchell was struck with the commonalities between fires and the COVID-19 pandemic. Dr. Diaz-Sanchez agreed with the commonalities and noted the relevancy of research since COVID-19's main transmission is through aerosol.

Efforts to Understand Fire Emissions and Their Locations

Beth Hassett-Sipple, Environmental Health Scientist, Center for Environmental Measurement and Modeling

Ms. Beth Hassett-Sipple provided an overview of the work characterizing measurements and modeling regarding wildland fires.

Wildland Fire-related Research: Measurements

Lara Phelps, Director, Air Methods and Characterization Division, Center for Environmental Measurement and Modeling

Ms. Lara Phelps discussed wildland fire measurement and characterization and how this helps in understanding the impacts of NAAQS compliance. She described the Air Methods and Characterization Division (AMCD) utilization of aerial vehicles (UAVs).

Ms. Phelps talked about the Mobile Ambient Smoke Investigation Capability (MASIC) and the multi-pollutant sensor pod appraisal. She discussed small form factor filter based PM samplers, which are being evaluated in the RTP area. Subsequent samples have been taken throughout COVID-19 for AMCD to evaluate.

Ms. Phelps highlighted the key points from the research studies on the Wildland Urban Interface (WUI). Emissions of criteria pollutants from structures in the WUI are miniscule compared to those from the natural fuels for the Thomas Fire. She mentioned that emissions of criteria pollutants are compared to other point sources as well. She discussed why lead emissions from fires are important, but such emissions from fires have never been inventoried. As such, she underscored that research has been focused on compiling more robust and complete results from inductively coupled plasma.

Dr. Senior inquired whether there is a current monitoring network adequate for capturing pollutants from wildland fires. Ms. Phelps replied it depends on whether the monitors are in the right place at the right time, and the appropriate instrumentation from a sensor network. Dr. Yelverton confirmed that sensors may in in the proper location but cannot always be safely reached and might not record measurement for that fixed area.

Ms. Keslar commented that the AirNow Fire Data Pilot was a helpful addition to understand how PurpleAir was comparing to the FRMs/FEMs. She asked if Ms. Phelps could discuss whether ORD is doing anything to develop sensors or if ORD is only testing sensors that are currently available. Ms. Phelps replied that they are testing the current sensors and participating in the development of new sensors.

Wildland Fire-related Research: Emissions and Modeling

Tom Pierce, Associate Director for Science, National Exposure Research Laboratory, Center for Environmental Measurement and Modeling

Mr. Tom Pierce provided an outline of current emissions and modeling research as well as the efforts of various research projects. The Atmospheric and Environmental Systems Modeling Division's (AESMD) involvement in the wildland fire related research is in the A-E Strategic Plan.

Mr. Pierce discussed fire-related research challenges and future directions. He stressed that the program needs to adapt to changing demands due to the frequent unforeseen requests that arise.

Dr. Kleinman asked whether the referenced publications on wildfires are indexed or available on the SharePoint site. Ms. Savannah Bertrand responded that only the slides will be found on the SharePoint and offered to post the publications.

Dr. Rivers inquired staffing issues would be discussed. Dr. Hubbell responded that the issue of engaging with and bringing in new scholars is important, and feedback would be welcomed.

Dr. Aneja commented on Mr. Pierce's allusion to the fire mass burning. He asked if there is an option that either the EPA or the U.S. Department of Agriculture (USDA) is considering that gets away from burning the residue. Dr. Yelverton replied that current research is occurring to address this.

Ms. Keslar inquired how the finished emission models are shared back to the federal land managers and the states. Mr. Pierce responded that the finished emission models are shared back and forth to make sure there is common ground.

Ms. Smith remarked that Mr. Pierce mentioned an example of relevant research that was not planned for and is not listed in the EPA Strategic Plan. Dr. Hubbell responded that relevant research was listed, but not added, to the EPA Strategic Plan.

Dr. Vette clarified the issue of hiring new young scholars. He stated ORD has mechanisms to obtain expertise in the young scholars, including a federal post-doc program and the Oak Ridge Institute for Science and Education (ORISE) program intended to function as a trainee situation. However, ORD cannot rely on either program to supplement their workforce. As such, any comments, inputs, and recommendations about how to address the ongoing staffing issues would be welcomed.

Dr. Arnold asked for more detail about partnering with other agencies to determine which program is most valuable. If ORD cannot argue for sustaining inter-agency efforts, the finds could be removed. He stated that he believes ORISE is cumbersome and expensive.

Insights from Partners/Users of Air and Energy Research

Kirk Baker, Physical Scientist, Office of Air and Radiation

Mr. Kirk Baker described how policy assessments and the evaluation of wildfires has changed. He underscored the importance of needing good representation as ORD goes through continual reviews.

As more refined information is available, Mr. Baker identified the need to continually update. He agreed that ORD should continue to improve the complex process of satellite-based fire detections and burn scares, among others.

Ms. Cara asked how the EPA or ORD is looking at fire issues or the work Mr. Baker has done with CMAQ. Mr. Baker replied that the models are used routinely for different purposes. He described how ORD is taking different modeling platforms and matching them with fuel measurements and use of satellite products. He concluded that ORD is compiling information for others to utilize.

Ms. Keslar asked if the modeling data has been used to understand why some fires will make ozone down-wind, and why some will suppress ozone far down-wind. Mr. Baker responded that ozone performance tends to overestimate. Principal investigators are trying to answer this complicated question.

Dr. Jeffrey Arnold commented that a 12km or a 4km model grid may not be the best place to look for the differences in ozone performance. He asked as to what is available on the ORD side for making the plans publicly available, referring to Ms. Keslar's previous question. Mr. Baker replied that there are currently two opportunities to acquire data. One is to work with ORD and take advantage of project data. The second is to reach out to the Office of Air Quality Planning and Standards (OAQPS).

Dr. Arnold responded that he was considering that grids be made available for people in the field or for individuals. Dr. Hubbell answered the plan is to make the EQUATES data available soon. Mr. Pierce also mentioned that various platforms are being explored where ORD could host the data more openly. The datasets are so large that it is challenging to find places to host the data.

Research for Understanding Health and Environmental Impacts and Potential Mitigations (Charge Question 3, Research Areas 3, 8, and 9)

Serena Chung, Environmental Engineer, Office of Science Advisor, Policy, and Engagement

Ms. Serena Chung provided a brief overview of the topics to be discussed and introduced the presenters.

Health Impacts

John Vandenberg, National Program Director, Human Health Risk Assessment Program, Center for Public Health and Environmental Assessment

Dr. John Vandenberg discussed exposure and health effects, organizing comments by the way of assessment, and interventions.

Dr. Vandenberg provided an overview of the individual air pollution exposure model that will be discussed in detail in Michael Breen's meet the scientist presentation. Cardiovascular outcomes are of particular concern because they are related to particulate matter exposure, which sets the stage for mortality outcomes. He mentioned different effects of systemic inflammation that can put stress on a cardiovascular system because of wildfire smoke. In North Carolina especially, the health effects of short-term exposure are seen through substantial problems with peat smoke. Some levels of exposure have been extremely high, relating to lung injury, cardiovascular dysfunction, and metabolic dysfunction.

Dr. Hains inquired how research results are shared with the communities being studied and whether community comments/feedback are used to direct research. Dr. Hubbell responded that

ORD is are actively communicating with partners. Ms. Hassett-Sipple added that the local public health agency and the Hoopa Valley Tribe have both been critical partnerships in the ASPIRE study.

Dr. Kleinman asked whether studies have been showing the visibility effects down-wind from fires and air quality. Dr. Vandenberg replied that the focus has been more on modeling data than visibility.

Mr. Croes asked whether the EPA has the authority to search different minimum efficiency reporting values (MERV) 13 or 16 requirements for new buildings or multi-family dwellings, since this information would be helpful to mitigate $PM_{2.5}$. Dr. Vandenberg responded that he does not believe the EPA has the authority to acquire such information.

Dr. Werner asked the connection between the A-E program and Office of Water (OW). Dr. Hubbell replied that they try to communicate with the Safe and Sustainable Water Resources (SSWR) program. He stated the SSWR program has funded work through national grants and is centered in the A-E program. He mentioned that OW, EPA Regions and states also have interest in the wildfire effect to water quality.

Ecological Impacts

Alan Thornhill, Director, Pacific Ecological Systems Division, Center for Public Health and Environmental Assessment

Mr. Alan Thornhill provided a brief overview on the Pacific Ecological Systems Division (PESD) research areas. The PESD is working with different products and integrating models. He discussed the HEXHAM modeling platform and the subsequent impacts on animals and plants. This modeling platform is based on natural history and helps to understand dramatic impacts of diseased trees in fire events.

Insights from Partners/Users of Air and Energy Research

Phil Dickerson, Office of Air and Radiation
Meredith Kurpius, EPA Region 9

Mr. Phil Dickerson discussed the AirNow program and the 2020 fire season. The current fire event in the West (2020 summer) is larger and of longer duration than the Campfire event of November 2018, which crashed the system. He described how the 2020 fire season was the first real test to evaluate the system. He noted that the site has moved to cloud.gov in April 2020 as 2018 server response time was substantially higher than 2020. He further highlighted that the new infrastructure has performed much better.

Mr. Dickerson discussed the AirNow sensor data pilot, launched on August 14, 2020, and ORD's creation of the correction equation that ORD created. He acknowledged confusion caused by introducing a new dataset of PurpleAir sensor data and explained that OAR would continue to integrate this sensor data with the current data.

Ms. Smith asked if the A-E program has plans to release the air sensor data. Mr. Dickerson noted ORD's correction equation helped address however he stated more information is not necessarily helpful. The traditional AirNow site is less useful during a fire because the monitoring network is

not necessarily near smoke impacted areas. Dr. Hubbell stated that OAR has been in discussion with states regarding the development of correction factors.

Ms. Keslar asked if the A-E program and ORD are researching isopleths and how they are generated on the traditional AirNow site. Mr. Dickerson replied that ORD will be an important part of the developing the vision for the site.

Ms. Meredith Kurpius discussed the need for public protection from wildfire smoke. She addressed the management needs of smoke exposure during wildland fires, including local smoke conditions, short-term and long-term health impacts/risks and guidance, effectiveness of interventions, and mechanisms to inform the public on when and which interventions to use. She discussed the Regional Applied Research Effort Program and several projects related to the use of air cleaners and masks. She stated the needs are local smoke conditions, decision support tools, solutions for low-resource communities and households and short-term and long-term health risks. She identified that there are effective models that provide actionable and available information with effective interventions.

Dr. Werner asked how communities would receive and use provided information. Ms. Kurpius and Dr. Sherri Hunt responded that issue is a topic the A-E program is trying to address. Dr. Hubbell added that grant money is being used to identify social and cultural communication factors.

Dr. Hains asked about the utilization of the state and local public health departments COVID-19 outreach efforts to communicate with communities regarding wildfire smoke. Dr. Hunt replied that they need to leverage the ongoing activities as much as possible. Dr. Geffen commented the delivery of the information in a simple-level format would be a good long-term goal. Dr. Hubbell stated that the Smoke Sense app was the intended to be the "easy-to-use" app, and plans are in place to sophisticate and expand upon this existing platform.

Meet the Scientists:

Room A

Public Health and Environmental Impacts, Session-Lead

Stephen LeDuc, Biologist, Center for Public Health and Environmental Assessment

Mr. Stephen LeDuc briefly addressed the group and introduced the three presenters.

Epidemiology

Ana Rappold, Statistician, Center for Public Health and Environmental Assessment

Dr. Ana Rappold discussed machine learning and artificial intelligence techniques to address environmental problems, lung function decrements in adolescents, and health effects and birth outcomes imparted by wildfire smoke.

Exposure

Mike Breen, Research Physical Scientist, Center for Public Health and Environmental Assessment

Dr. Mike Breen outlined the goals, approaches, inputs, and impact of the TracMyAir application and the use of smartphones to predict real-time air pollution exposures.

Ecology

Jana Compton, Center for Public Health and Environmental Assessment

Dr. Jana Compton discussed the ongoing research and observed effects at the wildlife-urban interface. She noted increase in nitrate, metals, volatile organic compounds, and disinfection by products. She stressed concern over the impacted water systems and immediate need to address this problem. Dr. Compton discussed tracking water contamination with PFAS and PFOS associated with firefighting foams.

Session 1 Q&A

Dr. Geffen asked about the challenges in finding and bringing in the right talent to make machine learning and artificial intelligence techniques to environmental problems. Dr. Rappold agreed the challenges are that machine learning is done in computer science and stressed that moving forward will require participation and collaboration between the computer science experts and the environmental health experts.

Mr. Croes commented on research surrounding chimpanzee studies where they are exposed to wildfire smoke and described lung function decrements in adolescents and health effects observed to be passed onto later generations. He inquired if that was what Dr. Rappold has been studying in humans. Dr. Rappold explained the research is investigating birth outcomes, diagnosis, and health effects in children. She discussed that there are chronic effects to wildfire smoke and efforts have been made to pass this information onto communities. She explained that if they know the health effects are long-term, they will perceive the wildfire risk as greater and will consider their actions differently.

Dr. Rappold mentioned that a group in Washington State received a NIEHS grant where individuals with asthma received three different levels of intervention and tracked to monitor exposure by the minute. She stated the study is now complete and at the data analysis stage. The study will provide her team with a lot of new evidence.

Session 2 Q&A

Dr. Kleinman inquired how the TracMyAir application will be distributed to the public. Dr. Breen responded the program is considering the integration of TracMyAir into the Smoke Sense application, which will be simplified in use and deployed publicly.

Dr. Kleinman and Dr. Breen discussed the Institutional Review Board (IRB) process and the distribution of data. Dr. Breen stated that the data (i.e., the output not the health data) has been used for multiple epidemiology studies with no issues.

Dr. Kleinman asked about the use of fire suppressants and if information on tracking water contamination with PFAS and PFOS associated with foams exists. Dr. Compton replied that ammonium phosphate is used as a fire retardant and the foams are usually applied to urban or residential areas. She followed that the regions have mentioned tracking PFAS and PFOS water contamination associated with foams moving forward.

Dr. Werner asked about the potential impacts on agriculture. Dr. Compton replied that the impacts of smoke on fruit has been raised, specifically wine grapes and their subsequent taste. She noted that there is potential for smoke to impact the production and quality of different crops.

Mr. LeDuc inquired whether benzene contamination affected the wild and urban interface affected. Dr. Compton explained Purdue University is studying benzene contamination and changes to the drinking water as PBC melts. She discussed how this is a distribution problem not a treatment issue. She added that there is also depressurization of the water systems which further aids in the contamination process.

Dr. Kleinman asked when TracMyAir application will be available to cellphones. Dr. Breen replied anyone with an iPhone can currently get TraceMyAir installed by invitation.

Session 3 Q&A

Dr. Senior asked how many people have downloaded the TracMyAir application. Dr. Breen replied that the application is going through the EPA process of being publicly available. He described that the application has been used in epidemiology studies and three separate pilot studies evaluating the application have been run in North Carolina.

Dr. Senior asked if TracMyAir would be publicly released in the next few years. Dr. Breen responded that public release is anticipated the summer of 2021. He offered the subcommittee if to email him for a version.

Dr. Aneja confirmed with Dr. Rappold that plans for artificial intelligence to be used for smoke detection and measurements for artificial intelligence are from satellite data. He inquired as to the algorithm being used to classify as artificial intelligence. Dr. Rappold replied that the study was done in Australia, using the new generation satellite. The study uses Convolutional Neural Network (CNN) from scientifically proven methods. He clarified that they train the algorithm through image recognition. He further elaborated that the smoke images can integrate and provide continuous collaboration with CMAQ, which delivers PM calculations.

Ms. Smith asked about training or aids in data interpretation for TracMyAir application. Dr. Breen responded that the publicly available application will have “how to” tutorials.

Room B

Emissions and Measurements, Session-Lead

Peter Beedlow, Scientist, Center for Public Health and Environmental Assessment

Dr. Peter Beedlow introduced the scientists.

Emissions

George Pouliot, Physical Scientist, Center for Environmental Measurement and Modeling

Dr. George Pouliot explained his research focuses on developing multi-year time series data for wildfire emissions. The need for the research arose due to inconsistencies in the methods and dataset inventory. Dr. Pouliout stated the goal of this research is to create consistent methods to measure wildfire emissions for modeling purposes.

Mobile Ambient Smoke Investigation Capability (MASIC) study

Matt Landis, Center for Environmental Measurement and Modeling

Dr. Matt Landis stated the primary goal of the EPA Mobile Ambient Smoke Investigation Capability (MASIC) study is to monitor ambient research sites for wildland fire smoke assessment. The need for this research arose from the fact there was no existing EPA regulatory structure to measure wildland fire smoke assessments.

Dr. Landis explained that the MASIC study team decided on three sites to conduct measurements: Reno, NV, Boise, ID, and Missoula, MT. The team also has mobile testing capabilities since many smoke events are transient.

With these sites and mobile testing capabilities, the MASIC study team can perform continuous gas monitoring, semi-continuous PM monitoring, integrated filter PM monitoring, sensor performance evaluation, and meteorological measurements.

Virtual Tour of EPA's Pacific Ecological Systems Division (PESD)

Jim Markwiese, Center for Public Health and Environmental Assessment

Dr. Jim Markwiese explained that the Pacific Ecological Systems Division (PESD) is strategically located on the U.S. West Coast to respond to high-priority research needs for wildfire impacts to human health and the environment. Dr. Markwiese emphasized that PESD has many research collaborations with universities and government agencies along the west coast.

Dr. Markwiese provided an overview of the Visualizing Ecosystem Land Management Assessments (VELMA) model. PESD uses the VELMA model to simulate ecological effects of wildfires, such as changes to soil, water, and vegetation.

Session 1 Q&A:

Ms. Smith asked if there was a breakdown of different emissions. Dr. Pouliot responded that the factors are based off a classification system that captures the variety of fuel types and how long the sources take to burn.

Ms. Smith asked if emission, to transport, to concentration, to metals can be linked. Dr. Markwiese explained that CPHEA has just begun looking at metal emissions from wildfires. Dr. Yelverton added that there has been conversation about metal emissions in terms of different forms of building materials, both home and business.

Session 2 Q&A:

Dr. Hunt asked if there was a way to observe the results of the research ahead of the papers being published to inform states on recommendation. Dr. Landis replied that there is a way to provide the data as they are already observing a pattern in the data. He described several complicating factors that are dependent on combustion factors.

Dr. Geffen complimented the group on their presentation. She inquired about the advances in sensor technology and if the presenters have been thinking about developing more autonomous and distributed sensor options. Dr. Landis answered that there are continued advances in sensor

technology and data presentation. He added CPHEA is actively engaging with scientists to develop new and more sophisticated sensor prototypes.

Session 3 Q&A:

Dr. Breen was impressed by the strong correlation between $PM_{2.5}$ and carbon monoxide (CO) and asked if CO could be used as a sensor for smoke exposure. Dr. Landis stated that CO is often used in smoke research as a normalized emission factor.

Dr. Yelverton asked if Dr. Landis could say more on the correlation depending on the type of fire, either smoldering or raging. Dr. Landis answered that fires are often characterized by background CO and carbon dioxide (CO_2). He added that EPA did not previously have smoke infrastructure making it difficult to characterize smoke affects without the proper measurements.

Room C

Translational Science and Communications, Session-Lead

Gail Robarge, Environmental Scientist, Center for Public Health and Environmental Assessment

Dr. Gail Robarge introduced the Meet the Scientists session. She explained how the scientists' research illustrates the emphasis the A-E program places on working with stakeholders and communicating with broader audiences. She highlighted that translational science means early and continual involvement in research that addresses a specific problem and leads to a solution. She emphasized that A-E Program is engaged in research that engages in risk communication.

AirNow Smoke Map Sensor Pilot

Andrea Clements, Research Physical Scientist, Center for Environmental Measurement and Modeling

Dr. Andrea Clements discussed her role in leading evaluation efforts, field campaigns, and research projects aimed at testing the performance and useability of air quality sensors. She described her work to evaluate air sensor technologies, specifically the AirNow Sensor pilot and provided an overview of associated research efforts.

Wildfire Study to Advance Science Partnerships for Indoor Reductions of Smoke Exposures (ASPIRE)

Amara Holder, Research Mechanical Engineer, Center for Environmental Measurement and Modeling

Dr. Amara Holder discussed her work to develop low-cost measurement systems used for communities to reduce their exposure to wildfire smoke. She highlighted concerns from stakeholders, including the efficacy of portable air cleaners during smoke events and the types of air quality monitors for wildfire smoke. She described the research to identify and quantify the impact of wildfire smoke indoors.

Smoke Sense

Mary Clare Hano, Environmental Health Social Scientist, Center for Public Health and Environmental Assessment

Dr. Mary Clare Hano described her work focused on addressing complex social problems. She discussed her current work on Smoke Sense, a citizen science study aimed at increasing the capacity of individuals and communities to respond to smoke events. She reviewed the objective of the study is to reduce the public health burden of wildfire smoke gap by increasing engagement among individuals and informing recommendation for wildfire smoke public health risk communication.

Session 1 Q&A

Regarding the ASPIRE study, Dr. Werner inquired as to the difficulty of retrofitting existing buildings to filter air and if there are alternatives if Heating, Ventilation, and Air Conditioning (HVAC) systems cannot be fixed or modified. Dr. Holder explained that retrofitting an HVAC system in existing buildings is extraordinarily expensive. Conversations have been had with building owners who were financially unable to make changes. She identified portable air filters and cleaners to be the best alternative. She described how air quality improved when the commercial units were running during the severe wildfire smoke in Hoopa, CA.

Dr. Rivers asked for Dr. Holder's thoughts on working with utilities at the residential level. He further inquired how EJ communities are being considered. The research is targeted to community spaces, rather than the homeowners. Her team is trying to gather the data and determine the best way to get the buildings "smoke ready" and then use the subsequent information to inform the homeowners and utilities.

Session 2 Q&A

Ms. Smith asked whether Dr. Clements could comment on the longevity, issues with calibration, and quality assurance/quality control of PurpleAir and other sensors in the Citizen Science context and whether the public is concerned about specific pollutants. Dr. Clements elaborated many sensors, made by several different manufacturers, and used by members of the public. These sensors allow data to be uploaded on a crowd source map. She described that their experience is that each device operates different. For instance, some overreport concentrations and others underreport. As such, there plan to develop methodologies for these sensors.

Ms. Smith further asked whether there is concern about the lifetime of these sensors and/or older sensors being used or sold in the EJ communities. Dr. Clements replied that the $PM_{2.5}$ sensors tend to have a longer lifetime than other pollutants, such as NO_2 or ozone.

Ms. Rohr noted how Dr. Holder's slides showed different MERV ratings and how some higher MERV ratings did not increase removal. Ms. Rohr asked if there is a way to expand the research. Dr. Holder explained how many buildings with HVAC systems could have been using higher rated filters but were not. She noted that most of these buildings were within school systems. She described an intervention study performed in a Leadership in Energy and Environmental Design (LEED) certified building use MERV 8. Dr. Holder identified that several buildings do not use the higher rated filters because their system would not have to work as hard, and expenses would be lower.

Dr. Holder explained the education to building owners about the usage of the dampers and doors. She found that the buildings with opening/closing doors had poorer air quality.

Ms. Smith inquired on Dr. Holder's efforts to implement risk communication with citizens and whether she has heard if there is a desire to know about pollutants. Dr. Holder responded that citizens have raised concern about CO, especially due to the wildfires. The residents in the mountain communities have asked about more sensors. They have not heard about a large concern of metals. Dr. Hano added that she has observed a strong interest from communities to better understand how to interpret the data, from citizens to partner agencies.

Ms. Smith asked the presenters what would make their job easier. Dr. Holder promptly stated that she would wish for more people with a passion to do this work. Dr. Robarge wished the staff had more time to focus on the science and less on the paperwork. She underscored a need to reduce the levels of approval and bureaucracy.

Session 3 Q&A

Dr. Geffen asked about materials, communication, and tools to reach subpopulations, such as the elderly and EJ communities. Dr. Hano agreed that access barriers are real, especially to those that are technology limited. There is a need for a more holistic approach and strategies. She stated that they are trying to determine what type of information they need and how to make it accessible. She added that they are looking at what is working at the state level to make more broad recommendations.

Mr. Croes expressed curiosity over Dr. Holder's efforts to evaluate air purifiers. He asked if they will be able to recommend certain models and provide specific guidance. He additionally noted that he observed businesses use undersized air purifiers during COVID-19 investigations and asked for Dr. Holder's recommendations in that area. Dr. Holder replied that the goal is to use the certification data under wildfire smoke conditions and see if the Association of Home Appliance Manufacturers (AHAM) certification is protective enough to protect against other chemicals. She explained that doing so allows them to identify how such conditions translate to wildfire smoke events. The research will demonstrate how effective air purifiers are for other chemicals.

Dr. Mitchell asked whether there was an issue of putting a bias in datasets because some groups of people simply do not want to participate. No one answered the question due to the time constraint.

Public Comments

Tom Tracy, Designated Federal Official, Office of Science Advisor, Policy, and Engagement

No public comments were registered.

BOSC Subcommittee Questions and Answers

Charlette Geffen, Chair
Sandy Smith, Vice Chair

Dr. Geffen moderated questions from the A-E subcommittee on the research on wildfire emissions pollutants, granular data and modifying air sampling networks for EJ communities, and quality assurance plans for research projects. The A-E subcommittee also discussed

collaborative climate change interlock with work that the DOE and other agencies. Dr. Rodan described COVID-19 research and budgets within ORD.

Dr. Aneja stated that the A-E subcommittee learned about research efforts into various pollutants from wildfire emissions. He asked if there is a database where EPA has put this information or is it still in the literature. Dr. Holder responded that the U.S. Forest Service (USFS) recently released a comprehensive database that is updated constantly.

Dr. Kleinman inquired whether the A-E program plans to have more discussions of granular data modifying existing air sampling networks for EJ communities. Dr. Hubbell offered that there was a recent Executive Order to develop a monitoring network for EJ communities. As such, the A-E program plans to modify existing networks for EJ communities.

Dr. Croes highlighted the emphasis on EJ communities and climate. He asked if that would distract from the work being done. Dr. Hubbell responded that the A-E program is looking for ways to leverage some of the work.

Dr. Mitchell expressed concern over the multiple instances of measurement data made by different types of instruments and inquired how the A-E program plans to make the data compatible. Dr. Hunt replied that the A-E program is looking at how all of ORD collects data, but they do not yet have a centralized way of compiling.

Ms. Keslar asked how the A-E program plans to develop QA plans for research projects. Dr. Yelverton responded that there are QA guidelines throughout all of ORD and each project has requirements for planning in place that is reviewed by QA managers.

Dr. Werner asked how the Program's work on climate change interlock with the work the DOE and other agencies are doing. Dr. Andy Miller replied that the A-E program has several venues to engage with DOE. Mr. Roden agreed and acknowledge that there is now a lot of effort to coordinate agencies on EJ and climate change. He identified that the White House is providing oversight going forward on these issues.

Ms. Smith asked if the A-E program has been thinking toward post-COVID-19 and travel for the future. Dr. Roden stated that most of the travel budget for ORD went straight to COVID-19 research and ORD has not begun discussions about future travel. Dr. Watkins elaborated that the A-E program will support field work where necessary.

Ms. Keslar asked about ORD staffing. Dr. Roden responded that ORD is close to 100% staffed.

Closed session for BOSC Subcommittee Discussion

Dr. Rivers stated the A-E program presentations were great examples of systems approach and cross-cutting areas. Dr. Mitchell agreed. Dr. Arnold thought the charge question about standard setting was odd. Dr. Geffen claimed that knowing that NAAQS is an endpoint goal for EPA, it makes sense that standard setting would be included in a charge question.

Dr. Senior noted that Charge Question 1 is broad, and the A-E subcommittee should provide more specific information. Ms. Smith suggested a review of the charge questions to initiate the preparation of suggestions and recommendations for the A-E program. The goal is for these

suggestions and recommendations to be broad, even looking towards the next Strategic Research Action Plan (StRAP).

Dr. Geffen added that the subcommittee can make the suggestions and recommendations specific to get deep into the science. Dr. Werner emphasized that the A-E program is looking to the subcommittee for "big picture" ideas. He noted that there will be new policies with the new administration.

Adjourn

The meeting adjourned at 5:45 p.m., Eastern Time.

Friday, February 19, 2021

Welcome – Day 3

The meeting reconvened at approximately 12:00 p.m., Eastern Time.

Welcome and Opening Remarks

Tom Tracy, Designated Federal Officer, Office of Science Advisor, Policy, and Engagement
Charlette Geffen, Chair
Sandy Smith, Vice Chair

Dr. Geffen and Mr. Tracy welcomed the participants. Mr. Tracy thanked Dr. Gilman for his participation.

Focused Discussion on Environmental Justice Challenges

Angie Shatas, Associate National Program Director, Air and Energy Research Program

Dr. Hubbell welcomed the participants and gave an overview of the two sessions.

Ms. Angie Shatas highlighted the motivation for the research. She outlined the A-E StRAP specifically mentions vulnerable communities and communities with environmental justice concerns. She identified that the challenge is to be honest about the time and resources needed to be fully engaged in research. She recognized the A-E Research Program's interest in ways to encourage their scientists to be more involved with these groups and enhance our research to be involved with vulnerable communities.

She reviewed the research implementation plan and EPA's collaboration with other national research programs. She reviewed the engagement plan moving forward.

Dr. Aneja expressed surprise that the EJ issues were not brought up surrounding the concentrated animal feeding operations in North Carolina. Ms. Shatas responded that a benefit to Mr. Michael Ragan at the helm is that the EPA has faced a diverse set of challenges. She stated her belief that he will bring perspective on this topic.

Dr. Aneja and Dr. Hubell discussed how EJ issues are a fine niche. Dr. Hubbell stated part of the challenge is that the A-E program has an existing program and acknowledged that these are complex issues that are not just technology and science related, but related to culture, jobs and homes. Dr. Hubell recognized the need to engage early with EJ communities.

Dr. Mitchel inquired if EJ populations share any commonalities or is each one unique. Dr. Hubbell explained they are not all the same, as each community has different experiences and challenges, and this aspect is part of what they are trying to address. He further outlined that in solutions-driven research projects, the focus is on creating generalized science. Dr. Shatas commented on the value of the EPA reaching out to broader research organizations.

Ms. Hassett-Sipple stated the A-E program is using lessons learned to amplify the message so other communities can follow suit. She identified this project is in the analysis phase,

Dr. Rivers suggested partnering with the North Carolina EJ Network, an organization that trains. people to be advocates in their own communities. He believes that the EPA may benefit from

this framework. Dr. Hubbell responded that once EPA has delivered information to a community, a plan does not exist to determine the effectiveness of the information in action. Dr. Rivers replied that most actions are political in nature and further pushed his point for the EPA partnering with people who can take the next step.

Ms. Smith asked what the EPA is doing to document lessons learned and share them with ORD and a broader audience. Dr. Hubbell replied that ORD has established a stakeholder engagement portal that has several resources available for these researchers. They are trying to learn from these exercises in effort to bring social science to answer the questions. He explained that the process is resource intensive.

Ms. Keslar recognized that it would be helpful for the states to plan for upfront engagement. She described EJSCREEN and asked whether there is ongoing support for the platform. Dr. Hubbell replied that EJSCREEN was not developed in ORD. He offered that there is a call within the climate crisis executive order for EPA to work with the Office of Science and Technology Policy (OSTP) to develop an expanded version. Dr. Hubbell suspects this process will build from EJSCREEN.

Ms. Keslar asked for more detail on the engagement with tribes. Dr. Hunt replied that the needs of African American communities are often different than tribal communities, which work through the EPA's tribal science program. She mentioned the work of the ORD's EJ counsel to prepare webinars where wildfire projects will be presented. She highlighted that the external mechanisms of engagement are a key connection to tribal organizations. Dr. Hains added the importance of post-project feedback. She identified that more outreach effort and strategies are needed.

Ms. Rohr asked how communities are selected for research being done and how research with EJSCREEN will evolve. Dr. Hubbell replied that communities are identified by interest and there is not yet an answer for improvements on EJSCREEN. Ms. Hassett-Sipple added that the EPA additionally works with their regional offices.

Regarding discussions with different communities in California, Dr. Kleinman noted that while cities are different, it is still critical to get solutions for these different communities. Dr. Hubbell commented that ORD is thinking about this topic. Dr. Frey explained that this deals with cross-cutting versus site-specific. He outlined that cumulative risk is something that impacted communities are expressing as an area of concern. He stated Dr. River's suggestions are aligned with for the priorities for the administration.

In response to Dr. Kleinman and Dr. Frey, Dr. Rivers explained the nature of sovereignty makes environmental justice tricky with tribal communities. He highlighted that, in North Carolina, the Lumbee tribe supports the idea of environmental justice, while the Cherokee tribe is federally recognized and may feel differently. Dr. Rivers asked if environmental justice communities are just black and brown communities, or white communities too. Dr. Hubbell replied that EPA is careful about ways to characterize communities.

Dr. Yelverton mentioned how agricultural communities may fall into Dr. Rivers' cited category in North Carolina. She thanked Dr. Rivers for the feedback on strategies to approach EJ communities and welcomed any additional ideas. Dr. Geffen stated that this is not just an EPA problem, but a scientific problem at large. She explained that this topic is about people in the science pipeline partnering with universities or other organizations to gain more representation of these communities within the science fields.

Air and Energy Engagement Strategy Update

Sherri Hunt, Principal Associate National Program Director, Air and Energy Research Program

Dr. Sherri Hunt reviewed the A-E Research Program team engagement strategy and described the motivation to record and assess what is going well, set a vision and concrete goals, identify ways to track and measure progress, and identify areas for improvement. She provided an update on the progress of engagement and discussed the audiences for outreach, communications, and engagement are grouped into three audiences: ORD, within EPA broadly, and beyond EPA. She provided a synthesis of outreach and engagement within EPA in 2020 and 2021, as well and outreach and engagement beyond EPA.

Dr. Senior inquired about the mechanisms to obtain more scientists. Dr. Hunt responded that there is a pathway of trying to make sure recognition is given to the scientists. She identified that performance appraisal and review processes are in place but acknowledged the continuing challenge.

Dr. Yelverton stated strides are being made in this area due to changes being made that limit heavy focus on a singular research effort. Ms. Phelps stated how the system has been revamped and made more concise, though she does not believe that the perception has changed. Ms. Phelps followed that any advice or ideas are welcomed.

Ms. Keslar commented on the ways to make data public. She stated that in her work with regional planning organizations, she noticed more outreach and believes more work with multi-jurisdictional organizations would be beneficial. Dr. Hunt noted more journal references on the are underway.

Dr. Kleinman stated EPA's presence at scientific meetings would provide information to broader audiences. Dr. Hubbell responded that with virtual meetings, there is less concern about travel expenses. Dr. Yelverton agreed that virtual meetings are less cumbersome, but the process to attend meetings could be more streamlined.

Dr. Rivers stressed the importance of sharing work directly with historically black colleges and universities, which do not have the same access to journal articles that other universities have, and it could introduce the EPA to younger ages as well. Dr. Yelverton replied that this is a great idea to share papers with universities that have less access.

Dr. Werner asked about the extent and effectiveness of which research is used. Dr. Hubbell replied that it is one thing to share research and it is another thing to know if the research has solved problems. Dr. Miller added that this speaks to the issue of accountability.

Overall Comments from BOSC Subcommittee

Charlette Geffen, Chair
Sandy Smith, Vice Chair

Ms. Keslar asked whether ORD has done any interaction or interpretation of smoke forecast models. She asked about engagement with the individuals who created the models. Mr. Pierce responded that ORD is implementing the Blue Sky and air quality models produced by the National Oceanic and Atmospheric Administration (NOAA). Ms. Phelps added that ORD works collaboratively with the USFS for the PurpleAir work.

Ms. Keslar asked about the meteorological research with short-term NAAQS or terrain effects. Mr. Pierce explained that there is not a strong meteorological component, however the Fairbanks, Alaska effort relies heavily on the meteorological aspect. Ms. Hassett-Sipple added a recent deliverable on wind tunnel studies has developed new algorithms to be imported into AirMod.

Mr. Croes inquired if the CSAQ document can made available to the subcommittee to obtain an overview on NAAQS related issues. Dr. Hubbell will deliver the information to the subcommittee.

Dr. Kleinman asked how the information of short-term impacts of wildfires will be factored into developing new PM NAAQS. Dr. Hubbell identified research examining shorter and longer exposures, as well as developing better response tools.

Dr. Mitchell asked about the stable isotopic work. Dr. Long stated the Corvallis laboratory is researching stable isotopes and will provide more information. Dr. Mitchell replied that he was thinking of both water and air aspects. He provided an example of how within particle analysis, those particles should not only have a chemical signature, but an isotopic signature. Dr. Long responded that he is unsure to what extent their capabilities are in that area.

Mr. Croes brought up how the EPA has done a lot of work on impacts of climate change on air quality. He asked if that work is being integrated into the NAAQS modeling. Dr. Hubbell answered that they have some projections out and will be running results through air quality models. He added that this will be discussed more in the next meeting. Mr. Pierce added that climate research will be covered in the next meeting.

Dr. Geffen noted that they need to decide the extent to which they want the EPA to participate with them.

Closed session for BOSC Subcommittee Discussion

Charlette Geffen, Chair
Sandy Smith, Vice Chair

Dr. Geffen requested the A-E program specify the end goal for the subcommittee's responses. Dr. Hubbell said the A-E program is not looking for recommendations on policy or regulations.

but clarity on how well the A-E program addresses the research gaps and/or needs in modeling methods.

Dr. Aneja expressed confusion about the question regarding mitigation, particularly when it comes to mitigating wildfires. Dr. Hubbell replied that when the A-E program refers to mitigation, it refers to scientific approaches to identify, evaluate, and combat wildfire. The A-E program also conducts research into ways to communicate wildfire risks, which can lead to their mitigation.

Dr. Arnold asked if the whether the subcommittee's responses should address climate. Dr. Hubbell stated climate comments related to the charge questions are acceptable, however the A-E program's climate-related work will be addressed at the next meeting.

The subcommittee members and EPA staff discussed the logistics of the report and workgroups.

Adjourn

The meeting adjourned at 6:00 p.m., Eastern Time.

Thursday, March 18, 2021

Welcome – Day 4 (March 18, 2021)

The meeting reconvened at approximately 2:00 p.m., Eastern Time.

Welcome and Opening Remarks

Tom Tracy, Designated Federal Officer, Office of Science Advisor, Policy, and Engagement
Charlette Geffen, Chair
Sandy Smith, Vice Chair

Dr. Geffen and Mr. Tracy welcomed the participants to the meeting and reviewed logistics. Dr. Geffen stated the meeting goal is to produce a final draft by the next meeting on April 2, 2021.

Charge Question 2: Discussion

Dr. Hains discussed the narrative and strengths within Charge Question 2. The group discussed NAAQS research and how the exposure and impact on susceptible communities is important. The group mentioned it is impressive the accomplishments over the past four years with the previous administration. Louie added that the list in the charge question document is not exhaustive, rather a few highlights. The suggestions focused on non-NAAQS pollution because of the way it effects environmental justice communities and vulnerable populations.

Dr. Geffen offered to address Charge Question 2 in more detail in the fall. Dr. Rivers agreed.

Dr. Geffen asked the subcommittee whether there was discussion about specific impacts that are within the scope of EPA. She clarified that she is curious as to the broad set of potential impacts. Ms. Rohr responded that this was not the focus, but something that could be discussed. Ms. Smith suggested using more explanatory text on why the non-NAAQS pollutants are important for EJ communities.

Dr. Kleinman voiced uncertainty that existing monitoring networks provide adequate resource and referenced complaints from individuals in these communities that the exposure is not being captured by the monitoring equipment available. He stressed necessary improvement to monitoring for criteria and non-criteria pollutants.

Dr. Senior stated that monitoring networks came up in both Charge Question 1 and 2. She inquired as to what part of that is in the A-E programs scope of work. She explained the need to better understand what ORD can do in this area. Dr. Hubbell replied that grants are given to states to determine where monitors go for regulatory purposes. He offered that ORD could work with communities on these decisions about regulatory models, but ultimately this is not up to ORD. He explained there are additional funds for EJ communities in the American Rescue Plan.

Charge Question 3: Discussion

Dr. Kleinman discussed the narrative for Charge Question 3. He stated that EPA has utilized given resources to examine wildfires and examined the issue with breadth that interacts with all programs in the portfolio. He outlined how EPA put an emphasis on wildfire impacts in environmental justice communities using modelling techniques.

Dr. Werner inquired the amount of research on the chemical composition of the particle versus chemical compositions from other sources. Dr. Hubbell replied that there is a lot of general

research. He explained that wildfire composition work has an increased emphasis. There is an increase in interest and there is a lot of work to be done on this front.

Dr. Aneja highlighted that the presentations made in the BOSC meeting did not allude to the composition of wildfire $PM_{2.5}$.

Dr. Mitchell underscored the importance of extreme boundary conditions if they move into more climate changes.

Dr. Kleinman stated that the work being done in the laboratory on how different burning conditions affects various toxic components is important. This leads to differences in smoldering fires versus more flaming conditions.

In terms of incorporating wildfires into NAAQS, Dr. Senior noted that ORD cannot re-write NAAQS. She asked if they would be more specific on what ORD can do to support, through modelling shorter-term measurements or compliance. Dr. Aneja replied that one of the charts presented stated 44% of the PM is believed to be coming from wildfires. He recognized the issue and stated they are offering up a potential solution.

Dr. Werner asked the timeframe for understanding chemical composition of $PM_{2.5}$. Dr. Hubbell replied there is work on the daily composition and on year-to-year variability, as well as day-to-day variability. He added that ORD is trying to enhance the use of mobile sensors.

Ms. Smith requested the groups refine the charge question document by the April 2021 meeting.

Friday, April 2, 2021

Welcome – Day 5 (April 2, 2021)

The meeting reconvened at approximately 2:00 p.m., Eastern Time.

Welcome and Opening Remarks

Tom Tracy, Designated Federal Officer, Office of Science Advisor, Policy, and Engagement
Charlette Geffen, Chair
Sandy Smith, Vice Chair

Dr. Geffen and Mr. Tracy welcomed the participants.

Charge Question 1 Discussion:

Dr. Senior described the recommendations for Charge Question 1. She explained how the suggestions were structured to specify the recommendations. The subcommittee questioned how models would be made available externally and internally to the Agency. The subcommittee clarified that field and point sources are considered large emission sources.

The subcommittee expressed confusion from suggestion 2 and inquired the meaning of a "large emission source." Dr. Arnold replied that specific language should be added to clarify.

Dr. Geffen added that it would be helpful to point out the research in the secondary effects as they had talked about compounding effects.

Mr. Croes requested clarification on sources that control tailpipe emissions and other sources like volatile chemical products (VCPs). Dr. Hubbell agreed that this would be helpful.

Regarding suggestion 3, Dr. Geffen asked the subcommittee if it should be a suggestion or does it have strength to be a recommendation. Dr. Arnold expressed confusion over suggestion 3. Dr. Rivers thought it strong enough to serve as a recommendation since the ensemble modeling is needed in the EJ space. Dr. Hubbell responded that ensemble modeling is included in the suggestions along with the potential influence of climate change. Mr. Croes clarified the articulated points about emission projecting should be grouped together.

Charge Question 2 Discussion:

Ms. Rohr discussed the suggestions and recommendations for Charge Question 2 and noted the connections to Charge Question 1. Regarding EPA's EJSCREEN, the subcommittee described how EJ communities should inclusively recognize urban and rural locations. EPA is going to need input from states and regional organizations to identify these rural populations. The subcommittee also discussed non-criteria pollutants.

Ms. Smith addressed the need for more specificity to make EJSCREEN more actionable. Dr. Hubbell replied that there is a White House initiative to create this tool. Within EPA, EJSCREEN is from the Office of Environmental Justice, not ORD directly. While it is effective to make this a recommendation, Dr. Hubbell expressed that he had wanted to share there is also a desire to recognize EJ communities are not just in urban locations.

Ms. Rohr commented that she did not recall the discussion, but Dr. Hubbell made an excellent point. Dr. Werner stressed the need for EPA to obtain input from states and regional organizations to identify these rural populations.

Dr. Werner asked how the A-E program could better promote non-criteria pollutants from a procedural perspective. Dr. Hubbell acknowledged the challenge. Ms. Rohr added that the EPA does not have direct responsibility and hoped the suggestion helps to acknowledge the non-criteria pollutants.

Charge Question 3 Discussion:

Dr. Mitchell discussed the suggestions for Charge Question 3 and commended A-E program's development of a series of wildfire products. Dr. Mitchell acknowledged that EPA has been effective in showing the linkages and noted it would be helpful to use the wildfires outputs to demonstrate how to incorporate different scales across different spaces. Dr. Aneja described the recommendations.

Adjourn

The meeting adjourned at 5:00 p.m., Eastern Time.

Appendix A: Agenda

United States Environmental Protection Agency
Board of Scientific Counselors (BOSC)
Air and Energy Subcommittee
Meeting Agenda
February 17-19, March 18, April 2, 2021
Virtual

February 17, 2021

Time (EDT)	Agenda Activity	Presenter
11:30 – 12:00	Sign on & Technology Check	
12:00 – 12:15	Welcome and Opening Remarks	Tom Tracy, Designated Federal Officer (DFO), Office of the Science Advisor, Policy, and Engagement (OSAPE) Charlette Geffen, A-E BOSC SC Chair Sandy Smith, A-E BOSC SC Vice Chair
12:15 -12:30	ORD Welcome	Jennifer Orme-Zavaleta, ORD Principal Deputy Assistant Administrator for Science
12:30 – 12:45	Overview of A-E BOSC SC Meeting Format and Charge Questions	Bryan Hubbell, A-E National Program Director (NPD)
12:45 – 1:00	Scientific Challenges and Key Uncertainties of National Ambient Air Quality Standards (NAAQS) Attainment (Charge Questions 1 and 2)	Bryan Hubbell, A-E NPD
1:00 – 1:15	Approaches for Addressing Scientific Challenges and Key Uncertainties of NAAQS Attainment (Charge Questions 1 and 2)	Tim Watkins, Center Director, Center for Environmental Measurement and Modeling (CEMM)
1:15 – 2:15	Research to Inform Decision Making and Plans to Meet NAAQS (Charge Question 1, Research Areas 1, 2, and 7) • Empirical and Computational Approaches to Inform NAAQS Compliance • Measurement Research to Inform NAAQS Decisions • Insights from Partners/Users of A-E Research	Tiffany Yelverton, CEMM Alan Vette, CEMM Lara Phelps, CEMM Kathryn Sargeant, Office of Air and Radiation (OAR) Chet Wayland, OAR

2:15 – 2:30	**BREAK**	
2:30 – 3:30	Considerations to Maximize Public Health Benefits (Charge Question 2, Research Areas 3, and 8) • Health Effects • Air Pollution Exposure • Insights from Partners	Tom Long, Center for Public Health and Environmental Assessment (CPHEA) David Diaz-Sanchez, CPHEA Lisa Baxter, CPHEA Rona Birnbaum, OAR Erika Sasser, OAR
3:30 – 5:00	**Meet the Scientists, Session #1**	
	Room A	
	Air Quality Modeling, Session-Lead	Rohit Mathur, CEMM
	Community Multiscale Air Quality (CMAQ) Modeling System	Christian Hogrefe, CEMM
	Long Island Sound Tropospheric Ozone Study (LISTOS)	Luke Valin, CEMM
	Volatile Chemical Products (VCPs)	Havala Pye, CEMM
	Room B	
	Health Effects, Session-Lead	Ian Gilmour, CPHEA
	Electronic Health Records	Cavin Ward-Caviness, CPHEA
	Epidemiology to Identify Environmental Justice Issues	Anne Weaver, CPHEA
	Air Pollution Toxicology	Mehdi Hazari, CPHEA
	Room C	
	Deposition, Session-Lead	Donna Schwede, CEMM
	Measurements	John Walker, CEMM
	EPA's Air QUAlity TimE Series Project (EQUATES)	Kristen Foley, CEMM
	Critical Loads	Chris Clark, CPHEA
5:00 – 5:15	**BREAK**	
5:15 – 5:30	Public Comments	Tom Tracy, DFO, OSAPE
5:30 – 5:45	Clarification Questions from BOSC SC	Charlette Geffen, A-E BOSC SC Chair Sandy Smith, A-E BOSC SC Vice Chair
5:45 – 6:30	Closed session for BOSC SC Discussion	

February 18, 2021

Time (EDT)	Agenda Activity	Presenter
11:30 – 12:00	Sign on & Technology Check	
12:00 – 12:15	Welcome Back	Tom Tracy, DFO Charlette Geffen, A-E BOSC SC Chair Sandy Smith, A-E BOSC SC Vice Chair
12:15 -12:30	Current Challenges posed by Wildfires	Bryan Hubbell, A-E NPD
12:30 – 12:45	Approaches to Address Current Challenges Posed by Wildfires	Wayne Cascio, Center Director, Center for Public Health and Environmental Assessment (CPHEA)
12:45 – 1:45	Efforts to Understand Fire Emissions and Their Locations (Charge Question 3, Research Areas 2,7, 9) • Wildland Fire-related Research: Measurements • Wildland Fire-related Research: Emissions and Modeling • Insights from Partners/Users of A-E Research	Beth Hassett-Sipple, CEMM Lara Phelps, CEMM Tom Pierce, CEMM Kirk Baker, OAR
1:45 – 2:45	Research for Understanding Health and Environmental Impacts and Potential Mitigations (Charge Question 3, Research Areas 3, 8, 9) • Health Impacts • Ecological Impacts • Insights from Partners/Users of A-E Research	Serena Chung, OSAPE John Vandenberg, CPHEA Alan Thornhill, CPHEA Phil Dickerson, OAR Meredith Kurpius, Region 9
2:45 – 3:00	**BREAK**	
3:00-4:30	**Meet the Scientists, Session #2**	
	Room A	
	Public Health and Environmental Impacts, Session-Lead	Stephen LeDuc, CPHEA
	Epidemiology	Ana Rappold, CPHEA
	Exposure	Mike Breen, CPHEA
	Ecology	Jana Compton, CPHEA
	Room B	
	Emissions and Measurements, Session-Lead	Peter Beedlow, CPHEA

	Emissions	George Pouliot, CEMM
	Mobile Ambient Smoke Investigation Capability (MASIC) study	Matt Landis, CEMM
	Virtual Tour of EPA's Pacific Ecological Systems Division (PESD)	Jim Markwiese, CPHEA
	Room C	
	Translational Science and Communications, Session-Lead	Gail Robarge, CPHEA
	Smoke Sense	Mary Clare Hano, CPHEA
	Wildfire Study to Advance Science Partnerships for Indoor Reductions of Smoke Exposures (ASPIRE)	Amara Holder, CEMM
	AirNow Smoke Map Sensor Pilot	Andrea Clements, CEMM
4:30 – 4:45	**BREAK**	
4:45 – 5:00	Public Comments	Tom Tracy, DFO, OSAPE
5:00 – 5:15	Clarification Questions from BOSC SC	Charlette Geffen, A-E BOSC SC Chair Sandy Smith, A-E BOSC SC Vice Chair
5:15 – 5:45	Closed session for BOSC SC Discussion	

February 19, 2021

Time (EDT)	Agenda Activity	Presenter
11:30 – 12:00	Sign on & Technology Check	
12:00 – 12:15	Welcome Back	Tom Tracy, DFO, OSAPE Charlette Geffen, A-E BOSC SC Chair Sandy Smith, A-E BOSC SC Vice Chair
12:15 – 1:00	Focused Discussion on Environmental Justice Challenges	Bryan Hubbell, A-E NPD
1:00 – 1:30	A-E Engagement Strategy Update	Sherri Hunt, A-E Principal Associate NPD
1:30 – 2:15	Overall comments from BOSC SC	Charlette Geffen, A-E BOSC SC Chair Sandy Smith, A-E BOSC SC Vice Chair
2:15 – 3:15	Closed session for BOSC SC Discussion	
3:15 – 3:30	Wrap up	Tom Tracy, DFO

Appendix B: Participants

BOSC Air and Energy Subcommittee Members:

Charlette Geffen, *Chair*
Sandy Smith, *Vice Chair*
Viney Aneja
Jeffrey Arnold
Bart Croes
Jennifer Hains
Cara Keslar
Michael Kleinman
Myron Mitchell
Louie Rivers
Annette Rohr
Constance Senior
Art Werner

EPA Designated Federal Officer (DFO): *Tom Tracy, Office of Science Advisor, Policy, and Engagement*

Presenters:

Kirk Baker*, Office of Air and Radiation*
Lisa Baxyer*, Center for Public Health and Environmental Assessment*
Peter Beedlow*, Center for Public Health and Environmental Assessment*
Rona Birnbaum, *Office of Air and Radiation*
Mike Breen*, Center for Public Health and Environmental Assessment*
Serena Chung, *Office of Science Advisor, Policy, and Engagement*
Mary Clare Hano*, Center for Public Health and Environmental Assessment*
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Andrea Clements, *Center for Environmental Measurement and Modeling*
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Christian Hogrefe*, Center for Environmental Measurement and Modeling*
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Bryan Hubbell*, National Program Director, Air and Energy Research Program*
Sherri Hunt*, Principal Associate National Program Director, Air and Energy Research Program*
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Other EPA Attendees:

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Greg Beachley
Tim Benner
Savannah Bertrand
Katie Boaggio
Ann Brown
Janet Burke
Anna Champlin
Ann Chelminski
Russell D. Owen
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William Fisher
Chris Frey
Alan Gilliland
Nicole Hagan
Michelle Henderson
Yong Ho Kim
Thomas Johnson
Nichole Kulikowski
Elisa Lazzarino
Andy Miller
John Offenberg
Lars Perlmutt
Melissa Puchalski
William Russo
Jason Sacks
Elizabeth Sams
Angie Shatas
Emily Snyder
Tayna Spero
Lindsay Stanek
Haiyan Tong
Lynn Trann
Tyrell Tyler
Chet Wayland
Jordan West
Andrew Whitehill
Pai-Yei Whung
Darrell Winner

Other Attendees:

Christina Bagdikian
Karoline Barkjohn
Paul Gilman
Hazel Gordon
Grand Knight
Ankita Mandelia
Carl Mazza
Tom Moore
Stuart Parker
Mary Ross
Ian Rumsey
Kathryn Saterson
Emily Trentacoste
Ron Washmann
Chris Weaver
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Appendix C: Charge Questions

1: ORD is pursuing a coordinated approach across disciplines and among partners to prepare the science necessary to support the development, periodic review, and attainment of the National Ambient Air Quality Standards. What suggestion(s) or recommendation(s) does the Subcommittee offer regarding progress to date of research activities to develop measurement and modeling methods and strategies to reduce concentrations of criteria air pollutants?

2: Reviews of the NAAQS rely on understanding exposures and associated effects and impacts to human health and the environment, including identification of at-risk populations and life stages. What suggestion(s) or recommendation(s) does the Subcommittee offer on how to enhance implementation of the research portfolio to optimize health and environmental benefits, particularly regarding the identification and characterization of exposures and responses in at-risk groups?

3: Recent increases in wildland fires activity have highlighted the challenges associated with protecting public health and environmental quality during these events. The A-E program is working to improve understanding of wildland fire impacts and to develop knowledge and tools to inform strategies aimed at decreasing negative effects. What suggestion(s) or recommendation(s) does the Subcommittee offer on the progress of the research aimed at identifying and mitigating the health and environmental impacts of wildfires?