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BOARD OF SCIENTIFIC COUNSELORS

CLEAN AIR SUBCOMMITTEE

Face-to-Face Meeting Summary U.S. Environmental Protection Agency Research Triangle Park, North Carolina June 8–10, 2009

MONDAY, JUNE 8, 2009

Welcome, Introduction, and Opening Remarks

Dr. Kenneth Demerjian, Atmospheric Sciences Research Center, Subcommittee Chair

Dr. Demerjian, Chair of the Board of Scientific Counselors (BOSC) Clean Air Subcommittee, called the meeting to order. He welcomed the Subcommittee members to the meeting and thanked them for their participation. He asked each Subcommittee member to introduce him or herself.

Dr. Demerjian explained that the Subcommittee's main objective is to review the U.S. Environmental Protection Agency's (EPA) Clean Air Research Program.

Designated Federal Officer (DFO) Welcome and Charge

Ms. Lori Kowalski, EPA/Office of Research and Development (ORD), DFO

Ms. Kowalski thanked the Subcommittee members for their attendance and reviewed the Federal Advisory Committee Act (FACA) procedures that are required for all BOSC Subcommittee meetings. All BOSC meetings are public meetings and include the opportunity for public comment, and as the DFO, Ms. Kowalski ensures that all FACA requirements are met and that records of board deliberations are made public. The minutes are being recorded by a contractor who will prepare a summary of the meeting; following review of the summary by the Subcommittee members and certification by the Chair, the summary will be available on the BOSC Web Site. Notice of the conference call was posted in the *Federal Register* and an electronic docket was established. The docket is available at <http://www.regulations.gov>; the docket number is EPA-HQ-ORD-2009-0225, and meeting materials can be accessed there, as well as at the BOSC Web Site. Subcommittee members must inform the DFO if they discover a potential conflict of interest with respect to any of the topics under discussion at this meeting. All meetings and teleconferences involving substantive issues, whether in person, by phone, or by e-mail, that include one-half or more of the Subcommittee members must be open to the public.

This face-to-face meeting was convened to provide an overview of the Clean Air Research Program, and was preceded by two public conference calls of the Subcommittee held on May 21, 2009, and May 29, 2009. The Subcommittee will review the Clean Air Research Program and provide a draft report to the BOSC Executive Committee. The next public conference call likely will take place in July. Subcommittee members should have received a supplemental mailing that included hardcopies of the posters to be presented at this meeting. The binders provided to Subcommittee members include a travel expense voucher and homework sheets. Ms. Kowalski requested that the Subcommittee members complete these forms and return them to her before leaving on Wednesday.

Although there were no advance requests for comment from the public, time for public comment is scheduled for 3:30 p.m. on Tuesday, June 9, 2009. Comments must be limited to 3 minutes each.

Subcommittee members should identify themselves prior to speaking so that the minutes may accurately reflect the discussion. All attendees should sign-in at the registration table.

ORD's Welcome

Dr. Larry Reiter, EPA/ORD, Acting Deputy Assistant Administrator for Management

Dr. Reiter thanked the Subcommittee members and explained that the BOSC reviews are very important management tools for ORD; they have a major impact on shaping ORD's programs. He thanked the Air Program team members for all of their hard work preparing for this review.

ORD is in a transition period in which its work and how the work is conducted are being reevaluated. Many of today's environmental problems transcend regulatory structures and scientific disciplines; thus, it is particularly important for ORD to have a stronger emphasis on integrated multidisciplinary research.

This face-to-face meeting is intended to help the Subcommittee members learn more about the Clean Air Research Program's work to address the environmental questions identified in the Multi-Year Plan (MYP) through presentations and interactions with the Program's scientists. The key questions are: Are we doing the right science? Are we doing the science right? Will the Program's research have an impact on addressing and solving Agency problems?

In 2008, the Clean Air Research Program MYP was restructured to better emphasize integration, approach research problems from a multidisciplinary perspective, and better communicate research results to the appropriate groups. Dr. Reiter asked the Subcommittee members to pay particular attention to whether ORD is taking full advantage of its integrated multidisciplinary capability in terms of how its programs are structured and how the research is conducted. Is the Program effectively communicating its research results to the Program Offices to ensure that the information generated is being used to inform decisions?

Welcome and Synopsis of ORD's Air Program

Dr. Dan Costa, EPA/ORD, National Program Director (NPD), Clean Air Research Program

Dr. Costa thanked the Subcommittee members for their efforts in reviewing the Clean Air Research Program, adding that their advice and guidance is very much appreciated. He welcomed and encouraged questions from the Subcommittee members.

This review is meant to provide the Clean Air Research Program with feedback on its progress since the last BOSC review and toward achieving its Long-Term Goals (LTGs). Many employees of the Clean Air Research Program have worked very hard to prepare this Program overview for the BOSC Subcommittee. Each poster that will be presented represents a research question and the work underway to address the question.

This face-to-face meeting will provide the Subcommittee with targeted and informative materials accompanied by spirited discussions leading to a thoughtful assessment of the Clean Air Research Program. Subcommittee members will rate the Program on the quality of the science, relevance to users, and the Program's overall performance. Questions to address include: Is the Program balanced and headed in the right direction? Is the Program making a real difference?

The 2008 revised MYP integrated particulate matter (PM), ozone, and air toxics under the Clean Air Research Program. The MYP focused on program integration and leveraging, taking multidisciplinary science approaches, multi-pollutant research, better communication of results, and regulatory support with a focus on public health outcomes.

The Clean Air Research Program's two LTGs are as follows:

- ✧ LTG 1 – Reduce uncertainty in the science that supports standard setting and air quality management decisions.
- ✧ LTG 2 – Reduce uncertainties in linking health and environmental outcomes to air pollution sources.

Why a source-to-health outcome approach? This approach recognizes that health outcomes are linked to sources via interconnected biological, chemical, and physical behaviors. The source-to-health outcome approach is being piloted in the near-road studies. Some of the health outcomes that have been ascribed to road proximity include asthma, birth defects, cancer, and adverse cardiovascular outcomes. The goal is to connect exposure and health outcomes.

The Clean Air Research Program's scientific leadership is recognized worldwide and EPA's air research has had significant regulatory benefits and impacts. Between 2005 and 2009, Air Program intramural and extramural scientists published 1,239 papers, one-third of which were highly cited papers. Key publications include journal articles on: a new paradigm for formation of secondary organic aerosols (SOAs), a demonstrated improvement in life expectancy, and the Community Multiscale Air Quality (CMAQ) model.

The Clean Air Research Program's work informs standard setting and benefits analysis. Air Program scientists work closely with ORD's Global Change Program scientists on climate change assessments. Near-road studies will inform the work of the Office of Transportation and Air Quality (OTAQ). ORD supports research on state and local issues by awarding Regional Applied Research Effort (RARE) grants to regional researchers.

There are many challenges and opportunities ahead for the Program, including: transitioning to a multi-pollutant approach; ensuring continued Program accountability; working on climate-air quality interactions; refining the National Ambient Air Quality Standards (NAAQS), taking into account both human and ecosystem impacts; refining exposure models; air monitoring development; studying the role and effects of renewable fuels; undertaking new toxicology research; and leveraging resources whenever possible.

Climate change is an emerging concern, but air quality will continue to be an important issue. It is now widely accepted that air pollution is much more than a respiratory issue and can impact the cardiovascular system, the nervous system, and can even affect birth outcomes. In fact, data support the NAAQS being set to lower levels to protect human health and the environment. Estimates of exposure, adverse health effects, and medical costs are increasing each year.

Discussion of General Program Issues

Dr. Dan Costa, EPA/ORD, NPD, Clean Air Research Program

Dr. Rogene Henderson wondered, with climate change and so many new environmental problems on the horizon, how the Program prioritizes its work. Dr. Costa responded that, for the next 5 years, the Program emphasis will be on continuing to support the NAAQS while also beginning the multi-pollutant work, including the near-road and source-to-health outcome work. The Program also will continue to work closely with the Global Change Research Program, leveraging that work to stretch limited resources. A research database to facilitate communication among researchers is in the early stages of development. This project is currently on hold, but the hope is that this project will be resurrected as it will do much to further promote collaboration and leveraging.

Dr. Tina Bahadori asked whether the Program was working with the National Institute of Environmental Health Sciences (NIEHS). NIEHS could benefit from the Air Program's research and the Air Program

could benefit from their resources, especially in the area of exposure biology. Dr. Costa said that the Air Program and NIEHS are working together. NIEHS is hosting an exposure biology conference in August that he is planning to attend. In addition, NIEHS developed a microchip sensing device that the Air Program may use in the field in the Detroit study. Dr. Bahadori wondered if a recommendation from the Subcommittee might help increase the collaborative work with NIEHS. Dr. Costa replied that they are in the beginning stages of working more closely with NIEHS; any additional resources for the Air Program would be welcomed.

Mr. Bart Croes noted that Dr. Costa mentioned that environmental justice was a potential area of emphasis for the new EPA Administrator and asked if there were any others. Dr. Costa said that climate change and energy issues likely will be areas of emphasis.

Dr. Melvyn Branch observed that Dr. Costa did not discuss indoor air quality and asked if it was an important issue for the Program. Dr. Costa said that indoor air quality is slightly different because it is not a mandated regulated environment. The Human Health Research Program does some work studying mold and the National Exposure Research Laboratory (NERL) is conducting some research on indoor air quality. It is not a particularly well-coordinated issue and, in all honesty, there is not enough funding to adequately address the issue.

Dr. Praveen Amar asked whether the Air Program leaders had considered other approaches beyond the NAAQS to improve air quality to protect human and ecosystem health. Especially for ecosystem health, the NAAQS might not be the best approach. Dr. Costa said that the Air Program leaders recognize that there are other approaches that might be more appropriate than the NAAQS.

Mr. Dirk Felton said that monitoring methods research seemed to be underfunded. Dr. Costa indicated that allocating funding to this type of research would mean cutting funding in another research area.

Dr. Demerjian said that the challenge is determining how to move the scientific community forward toward thinking about environmental problems from a multi-pollutant perspective. Does the EPA ask its researchers to consider these multiple aspects in their research projects? Dr. Costa stated that this is the direction in which the Program is heading. Dr. Demerjian added that one of the drivers that moves the science forward is new measurements. He envisions bringing together experts in the different disciplines (epidemiology, toxicology, etc.) to discuss how best to approach a given environmental problem. To him, it is not yet clear how to move forward in a multi-pollutant context. Dr. Costa agreed and said that this type of discussion will help the Program determine the best path for moving forward.

Session 1: Health and Exposure Research

Synopsis/Orientation

Dr. Robert Devlin, EPA/ORD, National Health and Environmental Exposure Research Laboratory (NHEERL)

Health and exposure research supports both Program LTGs through informing regulatory decision-making (LTG 1) and through multi-pollutant research (LTG 2).

This session is organized around three questions: What are the physical/chemical attributes of PM that are associated with adverse health effects? How and to what extent does PM cause adverse health effects? Who is susceptible to PM?

The posters in this session cover research on: PM size and the comparative potency of different size PM fractions, coarse and ultrafine PM health effects, PM components, and the health effects of long-term PM exposures.

The impact of this research will be demonstrated by client offices, which will be presenting posters describing how they use the data from the Clean Air Program's research, including how it is used in standard setting.

Poster Session for Health and Exposure Research

This poster session was held in the Atrium. The Subcommittee reviewed 19 posters in this session. During the 90-minute poster session, each Subcommittee member also had the opportunity to ask questions about the research or clarify specific points with the presenter(s). Poster abstracts and a book of poster reproductions were provided to Subcommittee members before the meeting.

Health and Exposure Research Poster Discussion Session

BOSC Clean Air Subcommittee

Dr. Murray Mittleman asked how the current scientific community thinking about multi-pollutant models plays into the research the Subcommittee members learned about in the poster session. Dr. Jonathon Levy asked for the researchers' thoughts on what the definition of multi-pollutant should be for EPA's activities. Dr. Devlin noted that the real multi-pollutant experts were in the audience and suggested asking these questions the following day. A researcher, however, noted that the exposure work already is taking into account multiple pollutants. The question is how to address the degree of action for each individual component of the mixture. One way is to conduct similar studies in different locations to identify the individual pollutants that are causing the different effects and develop hypotheses. Dr. Costa added that one central component of this approach was for the Program to help identify and support a host of next generation multi-pollutant statistical techniques.

Dr. Bahadori encouraged the Program leaders to take a step back and consider the bigger picture; it may be possible to look across the studies and identify a consolidated marker. Dr. Devlin said that one approach is to study toxicity pathways to determine the effects of different pollutants. Dr. Bahadori cautioned against studying specific pollutants and then taking a step back. Dr. Urmila Kodavanti said that the components research is working to identify common components to determine the primary drivers of health effects.

Dr. Ira Tager said that the focus on effects related to size was problematic; the search for a common property either within or across a size range would be a better approach. Searching for end chemical or physical products potentially could simplify this approach. Translating this to human health would require identifying usable surrogates. Dr. Joel Kaufman OR Schwartz responded that it is important to remember that EPA is a regulatory agency that mandates the reduction of specific pollutants; the research conducted informs these decisions. Dr. Arthur Cho said that because a person is exposed to a mixture of pollutants, it is essential that mixtures be studied in their entirety. The assays developed by the Program measure chemical reactivity, not just specific compounds; measures of overall chemical reactivity would seem to be a better way to investigate a multi-pollutant air parcel.

Mr. Felton asked why the PM framework is being used. Ms. Lydia Wegman noted that many people in the scientific community believe that the current system is outdated, but a better system for regulating air pollution has not yet been identified. Dr. Levy asked, if air toxics are less of a priority, is the new multi-pollutant framework not just a PM composition framework rather than cutting across multiple pollutants? Dr. Bahadori added that there often is a lack of resources to support this type of crosscutting approach. Dr. Costa responded that because of resource limitations, air toxics research was conducted as part of the Program's source-to-health outcome research.

Dr. Demerjian said that the posters showed that advancements are being made toward understanding biological issues related to exposure. With the near-road studies, it appears that there are some challenges in terms of source characterization and developing mitigation strategies. He asked how data will be

collected near-roads. Dr. Costa said that the monitoring program is under the Office of Air Quality Planning and Standards (OAQPS), not ORD. Dr. Demerjian said that ORD still should consider innovative ways to characterize near-road sources.

Office of Air Quality Planning and Standards (OAQPS) Perspective

Ms. Lydia Wegman, EPA/Office of Air and Radiation (OAR), Director, Health and Environmental Impacts Division

High-quality research is the backbone of credible and defensible Program Office decision-making. The research from the Clean Air Research Program is used in virtually every facet of the NAAQS review process and to support the implementation of the standards. The integration of the intramural and extramural programs at ORD ensures a strong scientific data base and provides the high-quality science that is needed to move policy decisions forward.

OAQPS works closely with ORD throughout the NAAQS review process. ORD develops an Integrated Science Assessment (ISA), which is a concise evaluation and synthesis of the most policy-relevant science. The scientific evidence in the ISA provides the foundation to inform the design and development of the Risk/Exposure Assessment (REA), which includes critical health/welfare endpoints, concentration-response functions, study populations (including consideration of sensitive subpopulations), study areas on which to focus, and evidence-based potential alternative standards for consideration. ORD also provides support for the policy assessment/rulemaking stage of the process. ORD's scientists and research are highly regarded throughout the world, which provides a strong foundation for OAQPS' decision-making.

Sources of scientific research relevant to NAAQS standard setting include: ORD (PM Centers, the Science To Achieve Results [STAR] Grants Program, and the Intramural Research Program), the NIEHS grants programs, the Health Effects Institute (HEI), the California Air Resources Board (CARB), and the Electric Power Research Institute (EPRI).

Important research for the future of the NAAQS includes: investigating frameworks for evaluating multi-pollutant atmospheres to understand the roles played by individual pollutants in contributing to the cumulative risk of air pollutant mixtures and considering different multi-pollutant approaches; improving understanding of particle components and attributes; and improving the ability to estimate and model exposure.

Discussion

Dr. Henderson asked if Ms. Wegman could foresee an air quality management approach that prioritizes and controls the most toxic sources. Ms. Wegman explained that approximately 3 years ago OAQPS created a sector programs and policies division that works across source categories. An example would be identifying all of the emissions points for petroleum refineries to determine the total pollution from that sector. In a way, this sector approach is taking a hierarchical approach because it focuses on the sectors where most pollutants originate. Dr. Amar asked if this sector-based approach could be an organizing principle for the multi-pollutant approach. Ms. Wegman responded that it could be an approach for individual source categories.

Public Health Perspective

Dr. Michael McGeehin, Centers for Disease Control and Prevention (CDC), Director, Environmental Hazards and Health Effects Division

Dr. Devlin explained that ORD actively seeks collaboration opportunities with other federal agencies. The Centers for Disease Control and Prevention (CDC) and ORD are working together on a health effects project that uses CDC health data and EPA exposure models.

Dr. McGeehin explained that CDC was mandated by Congress to begin the environmental public health tracking program, a national environmental surveillance program that combines environmental monitoring data, human exposure data, and disease data in one database; researchers can use the data to generate hypotheses on associations between environmental exposures and disease.

CDC has worked with ORD on the Public Health Air Surveillance Evaluation (PHASE) Project to develop better exposure estimates at different scales. The objective of this project is to demonstrate the advantages and limitations of methods of generating ozone and PM_{2.5} surface estimates for surveillance that can be linked with public health data. A number of different EPA models are used to link ozone and PM estimates to CDC and state health department asthma and myocardial infarction (MI) data and has been pilot tested in three states. The results from this project will eventually be made accessible to the general public on the Web. CDC hopes to continue to work with EPA to further refine the modeling techniques. Products from the PHASE project include: routinely available modeled air data on the Tracking Network, software for case-crossover analysis, and a how-to guide for the states that included information on how the models were developed, case definitions, risk factors, and so on.

EPA and CDC have jointly sponsored two workshops: a symposium on air pollution exposure and health held in September 2006 and a workshop on methodologies for environmental public health tracking of air pollution effects held in January 2008. A series of articles was published as a result of these workshops.

CDC plans to continue to work closely with ORD on air pollution issues.

Discussion

Mr. Croes asked about CDC's commitment to the PHASE project. What if the pilot projects prove to be successful? Dr. McGeehin responded that CDC has allocated between \$500,000 and \$600,000 to the PHASE project to date and is very committed to continuing the environmental public health tracking program as well.

Dr. Demerjian asked if CDC was planning to study the public health and environmental data in the tracking program retrospectively. Dr. McGeehin said that the project is prospective and currently there are no plans to analyze the data retrospectively.

Dr. Henderson asked if data from the analysis of air toxics in the blood is or will be used in the tracking program. Dr. McGeehin said that the granularity of that data might be a problem because it cannot be broken down any smaller than a regional level. The tracking program is trying to break down the data to the Zip code level.

Dr. Mittleman asked if there were any plans to study health outcomes beyond asthma and MI. Dr. McGeehin stated that the program eventually will be expanded to study additional health outcomes.

Human Health Research Program Coordination

Dr. Sally Darney, EPA/ORD, Acting NPD, Human Health Research Program

The Human Health Research Program was created approximately 10 years ago. The Program addresses crosscutting issues that are not media specific, drawing on air, water, and pesticide examples to make linkages between sources, exposures, and public health outcomes. The Program works to: 1) determine contaminant mechanisms and modes of action, 2) improve understanding of exposure, 3) improve understanding of susceptible populations for risk assessment, and 4) support pilot projects to determine the effectiveness of risk management decisions.

Human Health Program includes researchers with who also work in the Air Program. Also, the Human Health Research Program includes research of interest and applicability to the Air Office. For example, researchers in Human Health are using exposure and effects data to develop biological response models and plan to eventually develop a virtual lung model. The Human Health Research Program is working to determine if oxidative stress pathways in a variety of toxicities should be built into models for risk prediction.

The Clean Air Research Program has been a forerunner in the development of biomarkers of oxidative stress. Some of these biomarkers are being examined in the Mechanistic Indicators of Childhood Asthma (MICA) Study, which is leveraged with the Detroit Air Pollution Study. Another Human Health research project is investigating the usefulness of biomarkers in exhaled breath. Also, the SHEDS exposure model originally developed by the Human Health Research Program is being used in hybrid air pollution models. In collaboration with Region 1, EPA researchers are using a variety of air pollution models in New Haven, Connecticut, to determine the effectiveness of national, state, and local actions to mitigate air pollution. Another Human Health project is studying the developmental origins of health and disease. The Barker hypothesis states that children born to undernourished mothers often became obese; this may be a response to the lack of nutrition in the intra-uterine environment. The Human Health Research Program is developing an animal model to determine if chemicals that impact birth weight might have this same effect and are using toluene, an air toxic, as one of several model compounds. The National Children's Study will track children from *in utero* to adulthood. Human Health and Air Program researchers are lending their expertise to this study, especially with regard to air pollution monitoring methods. The Human Health Program also includes research to determine the extent to which prenatal or early exposures to pollutants may exacerbate asthma.

In sum, Human Health and Air Program researchers regularly collaborate to address both fundamental and practical science questions. The National Center for Environmental Research (NCER) recently released a Request for Applications (RFA) to support the development of environmental health outcome indicators. Many of the proposals received to date include plans to use models developed by Air Research Program scientists.

Discussion

Dr. Demerjian asked about the magnitude of the Human Health Research Program. Dr. Darney said that the Program has approximately 175 FTEs and an total budget of approximately \$60 million.

Dr. Demerjian asked how it is determined which Program will take the lead in the different research areas. Dr. Darney said that the NPDs meet with the Executive Council to discuss research strategies and priorities. The laboratories then develop the implementation plans that detail the research leads for the different projects.

Dr. Demerjian asked if the Human Health Research Program has input into the work conducted by the PM Centers. Dr. Darney said, not formally. Another participant noted that some of the representatives on

the internal advisory panel to the PM Centers also are on Human Health committees and are familiar with the research in both programs.

TUESDAY, JUNE 9, 2009**Review of Yesterday's Activities/Overview of Today's Agenda***Dr. Kenneth Demerjian, Atmospheric Sciences Research Center, Subcommittee Chair*

Dr. Demerjian explained that the agenda had been modified to provide additional Subcommittee discussion time. The poster session was shortened to 1 hour. The Subcommittee will have a quick lunch and then return for additional discussion on the morning session. A discussion session was added at the end of the day from 4:30 p.m. to 5:00 p.m.

Dr. Mittleman noted that the previous day's discussion was focused more on exposure than health and asked if there were any additional topics that the Subcommittee members would like his group to focus on in their written section. Dr. Tager suggested that the section cover whether the Program's work is adequately addressing source-to-health outcomes. Dr. Henderson suggested emphasizing the amount of progress made since the 2005 BOSC review.

Dr. Levy agreed that the posters represent both tremendous progress and interesting science. The important question, however, is how this work is helping in the NAAQS standard setting, in the development of state implementation plans, or in other targeted control strategies? He added that these questions may be answered by the posters in Session 3. Dr. Bahadori said that the research results need to be communicated to those who need it; the Program's communication strategies should be evolving along with the science.

Dr. Branch asked for clarification on what should be included in each workgroup's written section. Dr. Demerjian explained that the Subcommittee's report will address the charge questions. Program assessment is broken down into program design and leadership. Dr. Mittleman will serve as the lead for the Program Assessment workgroup, working with Dr. Branch, Dr. Bahadori, and Mr. Felton to draft that section of the report. Dr. Branch asked if the entire group could provide input on all of the charge questions.

Dr. Demerjian confirmed that all of the Subcommittee members will have the opportunity to provide input on the full report; he assigned workgroups to ensure that each question is covered. The summary assessment is the Subcommittee's assessment of progress made toward meeting the LTGs; all Subcommittee members will contribute to that section. The Subcommittee will need to determine a rating for each LTG and include examples to support the ratings assigned. He confirmed that the Subcommittee will discuss the ratings the following day; the group must eventually come to a consensus on the ratings.

The Subcommittee members decided to meet in their workgroups for the next half hour.

Workgroup Meetings**Session 2: Air Quality Management****Synopsis/Orientation***Mr. Ken Schere, EPA/ORD, National Exposure Research Laboratory (NERL)*

Air quality research supports LTG 1 through NAAQS development and implementation, and LTG 2 through the tools developed to connect sources to health and to characterize multi-pollutant concentrations. Session themes will include: source emissions (estimation and evaluation), ambient measurements (air quality characterization and process insights), air quality modeling (applications driving development and evaluation), and extending applications of methods and models (linking to ecosystem effects, human exposure, and climate assessments).

Mr. Schere gave an overview of the different science topics covered by the air quality research and the posters to be presented under each topic.

The air quality research overlaps with the research in the two other sessions. For example, the work on monitoring methods presented by Dr. Robert Vanderpool is related to the PM and atherosclerosis work presented by Dr. Joel Kaufman, the research on the impacts of stationary and area sources of air pollution on air quality and human exposures presented by Dr. Janet Burke, and the work on the impact of multiple sources on an airshed presented by Dr. Gary Norris. The poster on the use of air quality management tools to improve exposure assessment presented by Dr. Vlad Isakov is linked to the work on novel approaches to improving exposure characterization and risk estimates of air pollution effects presented by Dr. Lisa Baxter and the work on the effectiveness of airshed/sector-specific regulatory actions presented by Dr. Val Garcia. The coarse particle measurements poster presented by Dr. Michael Hannigan is connected to the work on the effects of coarse particles presented by Dr. Carraway.

Poster Session for Air Quality Management

This poster session was held in the Atrium. The Subcommittee reviewed 21 posters in this session. During the 90-minute poster session, each Subcommittee member also had the opportunity to ask questions about the research or clarify specific points with the presenter(s). Poster abstracts and a book of poster reproductions were provided to Subcommittee members before the meeting.

Air Quality Management Poster Discussion Session

BOSC Clean Air Subcommittee

Dr. Amar asked how the volatility basis set work would be linked to the treatment of SOAs. What is the timeframe for this? Dr. Prakash Bhawe (ORD) responded that the volatility basis set is currently in the research phase; the plan is to transition into a research version of the CMAQ model that could then be compared directly with the regulatory version of the model; this should occur within the next year or two. Dr. Neil Donahue (Carnegie Mellon) added that this work involves a great deal of collaboration among researchers and eventually will be integrated into the regulatory models.

Mr. Felton asked if the results of the volatility studies will be used to inform the Federal Reference Method (FRM) and/or the Federal Equivalent Method (FEM). Dr. Vanderpool (ORD) responded that there is no immediate push to change the reference method to account for organic volatility.

Dr. Greg Yarwood asked if the researchers thought that intermediate volatility organic compounds (IVOCs) are important contributors to PM formation. If so, is there currently enough information on the magnitude of those emissions? A researcher responded that the laboratory experiments conducted to date strongly suggest that the IVOCs are being oxidized and contributing to SOA. That said, there is still a significant amount of uncertainty in this area, so additional research is needed. Dr. Yarwood asked how ORD plans to address this issue. Dr. Mike Hays (ORD) said that ORD is working to characterize near-source emissions. Dr. Yarwood commented that there did not appear to be a lot of work on air toxics emissions compared to other emissions. Dr. Hays said that air toxics are routinely measured; this is viewed more as a necessary routine measurement than as a research question. Mr. Schere added that the Clean Air Research Program is working with OAR to normalize the criteria emissions inventory with the air toxics inventory to create one consolidated inventory. Dr. Rich Cook (OTAQ) said that his office routinely measures air toxics as part of its mobile source work. Much progress has been made on the air toxics inventory in recent years and the information collected is helping to improve the quality of CMAQ predictions. Mr. Croes said that while progress is being made, the criteria pollutants seem to be missing. With the increasing emphasis on climate change, will there be research on pollutants such as black carbon and methane? Dr. Ted Russell (Georgia Tech) said that the criteria pollutants are still an active concern. Ms. Sherri Hunt (ORD) added that a STAR Grant Emissions Inventory RFA recently closed; proposals will be reviewed soon. Also, some of the projects funded under STAR studying organic emissions are

actually studying a variety of sources. Mr. Schere said that there is overlap between the Air Program and EPA's Global Change Program; the research is moving in the direction of focusing more on large-scale global inventories. Although there has been limited progress to date, this research will be significantly expanded in the next 3 to 5 years.

Mr. Croes asked if verifying the achievement of emissions reductions is part of the accountability framework. Mr. Schere replied that Dr. Russell's poster on using satellite measurements for verification was one method of verifying reductions. Beyond direct emission verification, ORD sponsored a program that identified power sector emissions reductions in the eastern United States.

Dr. Yarwood commented that while much excellent work is occurring in atmospheric chemistry, it appears that core gas phase chemistry is missing. Dr. Deborah Luecken (ORD) said that there is still much uncertainty in this area; there definitely could be more support for this type of work.

Dr. Amar said that he thought that ORD at one time was considering replacing the CMAQ; what is the status of this effort? Mr. Schere clarified that the CMAQ would not be replaced but would be integrated with the Weather Research and Forecasting-Chemistry (WRF-CHEM) model. The first formal release of the integrated WRF-CMAQ model is slated for 2011.

Dr. Demerjian asked how the Clean Air Research Program researchers and exposure researchers work together. Mr. Schere said that the Air researchers work closely with NERL's exposure modelers. Mr. Tim Watkins added that measurements from the near-road studies will be integrated with exposure modeling data. Dr. Demerjian said that it is essential to determine what occurs in real-world situations and asked if better measures for characterizing emissions would be developed. For example, in the Detroit study, it was not clear how the inventory would be corrected to better reflect real-world exposures. Mr. Watkins said that this was not part of the Detroit field work. Dr. Cook agreed that laboratory measurements are not always representative of real-world operations. For heavy duty diesel, trailing experiments are conducted to collect plume measurements to obtain a more realistic dilution that cannot be accounted for in a dynamometer setting. The researchers recognize the importance of these issues. Dr. Hays added that STAR grant researchers at the University of Southern California have taken tunnel measurements and reconciled them with emissions inventories.

Mr. Felton asked how emerging measurement technologies are selected for study. Mr. Watkins explained that the ambient measurements program supports: 1) the development and evaluation of the methods needed for NAAQS compliance and 2) research on other measurement methods. Work is prioritized and resources are allocated within this structure.

Dr. Amar asked whether there are guidelines on when and when not to use satellite data. Mr. Schere said that programs are increasingly using satellite data, so ORD is working to better understand the information obtained from satellites. Dr. Russell added that satellite data provide unique information, but it is understood that there are still many issues with satellite data. Mr. Schere agreed.

Dr. Tager noted that the research presented in the session was largely in support of LTG 1 and asked how it is connected to supporting the source-to-health paradigm of LTG 2. Mr. Watkins said that there are efforts to extend the air quality models and integrate them with exposure models; this connection between air quality and outcomes can inform the source-to-health outcome discussion. Many of the methods used in the Air Program also can be applied to other activities studying health outcomes. Dr. Alan Vette (ORD) said that the connection will be evident in the next session. Many of the modeling and measurement tools developed to support LTG 1 also are being applied to understand source-to-health outcomes.

State/Local Perspective

Mr. Michael Gilroy, Puget Sound Clean Air Agency, Manager, Meteorological and Technical Services

The Puget Sound Clean Air Agency serves approximately 3.5 million residents in the Puget Sound area. The Agency works to generate and use data operationally; access to scientific resources that exceed the scope and capabilities of the Agency is essential. ORD is one source of this scientific information.

Collaboration is essential to success because research must produce operational and policy relevant results. Local scientists collaborate with ORD through the STAR Grant Program by leveraging data and sharing methods work. Regional technical and scientific liaison personnel serve as guides and partners for working with outside agencies; they played an instrumental role in alerting ORD about the need for near-road studies. RARE grants are another avenue to connect ORD to regional and local scientists; however, it is often difficult to identify an ORD scientist to sponsor a RARE grant. The Puget Sound Clean Air Agency has representatives on the National Association of Clean Air Agencies (NACAA)/EPA OAQPS Monitoring Committee and works with the National Oceanic and Atmospheric Administration (NOAA) on their air quality forecasting efforts.

It is essential that ORD establish research goals that bear operational and policy relevant results. Ideally, a research product would be operational in 18 to 36 months. Local scientists need a new suite of tools to measure air quality. In particular, the Puget Sound Clean Air Agency needs a diesel particulate measurement, a wood smoke particulate measurement, and meteorological measurements for boundary conditions. The Puget Sound Clean Air Agency hopes that resources will be allocated to developing these measurements.

Discussion

Dr. Demerjian asked for more information on the RARE grants. Mr. Gilroy explained that they are ORD-funded grants to support regional research. To apply, regional investigators must identify an ORD project officer or mentor to work on the project. Dr. Costa added that RARE grants offer \$2 million in funding each year across all ORD programs. They are competitive grants that offer \$200,000 per year to address region-specific issues.

Session 3: Source-to-Health Outcome: Multi-Pollutant

Synopsis/Orientation

Dr. Alan Vette, EPA/ORD, NERL

To achieve LTG 2, the Clean Air Research Program will develop a multi-pollutant approach to research; identify specific source-to-health linkages, using near-road studies as the prototype; and assess health and environmental improvements due to past regulatory actions. While not specifically identified as a focus in the Clean Air multi-year plan, the multi-pollutant approach will be developed with consideration of the research on air quality-climate interactions being performed concurrently in the Global Change Research program.

This session will include posters on four themes: linking multi-pollutant sources and health effects, atmospheric transport and transformation, the influence of airsheds on multi-pollutant air quality and health effects, and assessment and management of multi-pollutant exposures and health effects.

Posters representing the linking of multi-pollutant sources and health effects cover: the source-to-health outcome approach, the recent emphasis on near-road studies, assessing the impact of stationary/area sources, and primary emissions.

Atmospheric transport and transformation posters cover how source emissions undergo chemical reactions in the atmosphere with an emphasis on organic aerosols, NO_x, HAPs, O₃, etc.; the potential for reactions to alter toxicity; and the atmospheric production of reactive species and secondary products.

Posters on the influence of airsheds on multi-pollutant air quality and health effects cover regional differences in observed health effects, assessment of local and regional contributions, and the design and evaluation of regulatory actions to improve their effectiveness in a multi-pollutant context.

The theme of assessing and managing multi-pollutant exposures and health effects will include posters on simultaneous exposure of humans to multiple pollutants, the effect of sources and origins of multi-pollutant atmospheres on toxicity, and the development of mitigation strategies to reduce multi-pollutant source emissions.

Client posters will show how they have used the Program's research in their work.

Poster Session for Source-to-Health Outcome: Multi-Pollutant

This poster session was held in the Atrium. The Subcommittee reviewed 16 posters in this session. During the 90-minute poster session, each Subcommittee member also had the opportunity to ask questions about the research or clarify specific points with the presenter(s). Poster abstracts and a book of poster reproductions were provided to Subcommittee members before the meeting.

Source-to-Health Outcome: Multi-Pollutant Poster Discussion Session *BOSC Clean Air Subcommittee*

Dr. Tager asked what ORD sees as the next steps for the multi-pollutant approach. Dr. Costa said that the first step is defining multi-pollutant. OAR and ORD have held an internal workshop to discuss ongoing work that fits into the broad definition of multi-pollutant. Another workshop will be held and will include outside experts and OAQPS, with policy expert presentations on the first day and discussions between the policy experts and the scientists on the following day. The near-road studies are really the beginning of the multi-pollutant work. Dr. Tager asked how the decision was made to focus on source-to-health outcomes. How does that fit into deciding on a definition for multi-pollutant? Dr. Costa said that the source-to-health outcome approach evolved out of ongoing research at ORD. Research on tunnels, airports, and ports is already underway, but is not yet integrated. The advantage of having an Agency with intramural researchers and a stable budget is that you have the ability to do this type of cutting-edge work.

Dr. Amar said that the near-road studies may not be applicable to other sources. Dr. Costa agreed that near-road may not be the right model for all sources. However, OTAQ, OAQPS, and regional clients are all interested in near-road studies, so it is a good starting point. Dr. Amar agreed, but wondered if it is the right model to extend to other sources. Dr. Vette explained that the multidisciplinary approach is more the prototype than the actual studies themselves.

Dr. Levy said that near-road is a challenging example because there are multiple sources. What is the conceptualization of source within this framework? Will the work focus on fuel types and other attributes? Or will it focus on broader topics such as urban planning? Dr. Vette said that the researchers are trying to learn about solutions through better understanding of the problem. Dr. Rich Baldauf (ORD) noted that part of the challenge is that ORD is a research division within a regulatory agency. The sources of concern will depend on what the Agency is trying to address. He added that there are both benefits and challenges to using this model.

Dr. Henderson asked how the Agency plans to develop policy to control adverse health effects from air pollution. She wondered if EPA would use the maximum achievable control technologies (MACTs) and

then study residual risk. Dr. Vette said that using the NAAQS and MACTs will be considered, but the approach has not yet been determined.

Dr. Branch said that the responses to the client survey indicated a need for information on near-road emissions and health effects. Are there plans to develop more realistic modeling of the near-road environment (including sources and atmospheric transformation)? Dr. Baldauf explained that dynamometers have been used to better characterize near-road emissions. Other work will help improve ORD's ability to characterize air quality concentrations and exposures at the road scale. Also, researchers are working to further improve the algorithm to characterize the barrier and roadway configuration effects. The work on atmospheric transformation will occur later.

Dr. Demerjian asked if the researchers have plans to compare near-road emissions with aged emissions to show if freshness plays a role in toxicity. Dr. Kleeman noted that animal exposures both near roads and further away from roads will be studied, so there will be some information on freshness.

Questions/Answers With PM Center Directors

*Dr. Kenneth Demerjian, Atmospheric Sciences Research Center, Subcommittee Chair
BOSC Clean Air Subcommittee*

Dr. Bahadori asked for the PM Center Directors' views on the potential for a multi-pollutant standard. Dr. Anthony Wexler (University of California, Davis, San Joaquin Valley Aerosol Health Effects Research) said that experiments on rats at his Center have shown that their airway morphology changes when exposed to premixed particles. Ozone added to the mixture appears to mitigate most of the changes. Dr. Michael Kleinman (Southern California Particle Center) said that a multi-pollutant standard is not necessarily needed. Mixtures are often concentration-dependent, so there may be circumstances where it would be better to lower PM standards in locations with high ozone levels; this may result in stricter regulations on some sources and loosening the standards on others.

Dr. Demerjian asked if human exposure studies using either ambient particulates or concentrated ambient particulates will be conducted. Will these types of experiments be needed to understand these multi-pollutant synergies? Dr. Wexler said that this is one of many endpoints that can be relevant to health effects. Their experiment results will be useful for the near-road studies as the near-road area is one where ozone is low and particles are high (this had the most effect on developing lungs in the experiments). In terms of the differences between laboratory exposures and real-world exposures, a major challenge is that it is difficult to repeat a CAPs experiment because the air is different from day to day. Dr. Petros Koutrakis (Harvard) pointed out that epidemiologists perform studies on different days under potentially different conditions. There is value in both types of studies. Dr. Gunter Oberdorster (University of Rochester) said that his center is focused on studying ultrafine particles. He stated that researchers should focus first on the most reactive sources.

Dr. Branch commented that the basic motivation behind the multi-pollutant approach is the studies showing synergistic, antagonistic, or neutral effects of combined pollutants. The more compelling motivations that can be identified, the better. Also, researchers may find that reducing one particular source is the most effective strategy, but can one source be singled out within the current regulatory framework? Ms. Wegman said that there is no simple answer. Her office works within the framework of the Clean Air Act (CAA) and is pilot testing air quality management plans to determine the results of controlling certain pollutants. The right solution will likely vary from location to location. Dr. Kleinman pointed out that EPA's mandate is to protect human health and the environment, so it is not that it would be picking on an industry, but instead controlling a harmful pollutant.

Dr. Demerjian asked if the Center Directors' work will show that a PM mass standard is not the most effective control strategy. Dr. Dominici said that she believes that there will be compelling evidence that some of the components of PM are more toxic than others. The work probably will not lead to a revision of the PM standard, but will contribute important information. Dr. Koutrakis said that the PM Center Directors are all disappointed not to have found the PM silver bullet. The research to date has produced some important information, but future research should focus on sources and toxicology.

Dr. Henderson asked if there was anything that the Subcommittee could recommend to EPA to improve the Agency's interaction with the PM Centers. Dr. Oberdorster said that the Center Directors interact with each other and with EPA employees on a regular basis and receive everything they need from EPA. Dr. Dominici said that her experience working with EPA has been great; she had no suggestions for improvement. Dr. Koutrakis responded that he appreciated working with the excellent EPA intramural scientists.

Public Comment

Ms. Lori Kowalski, EPA/ORD, DFO

Ms. Kowalski called for public comment at 3:30 p.m.

Dr. Ken Sexton (University of North Carolina at Chapel Hill) said that it is important to study specific sources and toxicity. One poster showed that mixing a nontoxic source with another source resulted in an inflammatory signal; this is an obvious starting point for a multi-pollutant approach.

Ms. Michelle Palmer (EPA Region 5) stressed the importance of working across media (e.g., air, water, etc.) when taking a multi-pollutant approach.

No other comments were offered.

Global Change Program Coordination

Dr. Joel Scheraga, EPA/ORD, NPD, Global Change Research Program

Dr. Scheraga explained that the Clean Air Research Program and the Global Change Program are inextricably linked. Through this partnership, the Air and Global Change Programs support EPA's mission by providing timely and useful information to the Agency about the implications of global change (including climate variability and change) and air quality in the United States. Each program has benefited from the work of the other; scientists from the two programs work together on a number of issues and will ultimately work to develop integrated adaptation and mitigation strategies across media to inform decision-making.

The mission of the Global Change Research Program is to assess the potential consequences of global change—particularly climate variability and change—in the United States. Areas of focus include: air quality, water quality/aquatic ecosystems, and human health. Historically, the Global Change Research Program has focused on evaluating adaptation strategies to reduce risks posed by global changes. More recently, the program's mandate has broadened to include assessment of the environmental and human health implications of alternative mitigation strategies. The Global Program is also developing decision support tools that enable resource managers and other stakeholders to incorporate considerations of climate change into their day-to-day operations. Much of the Global Change Research Program's work supports the EPA's role in the CAA, the Clean Water Act, and the Safe Drinking Water Act.

EPA currently is working on an assessment to determine the potential impacts of climate change on air quality in the United States. This involves a major assessment of the sensitivity of goals articulated in the CAA to climate change and the opportunities available within the provisions of the CAA to adapt to

anticipated impacts. To date, the assessment has shown that climate change should be considered by air quality managers as they develop air pollution control strategies. Climate change has the potential to produce significant increases in ground-level ozone in many regions. Nonattainment areas will have a more difficult time achieving their clean-up goals and areas that are barely in attainment may be pushed into nonattainment. A 2009-2010 assessment will focus on the health implications of projected changes in air quality (specifically ground-level ozone) due to climate change. Currently, air quality managers are overwhelmed by the amount of information available and need to know how to operationalize that information.

Discussion

Mr. Croes asked if the Program scope included non-Kyoto climate forcers such as black carbon and ozone precursors. Dr. Scheraga said that the Program scope includes these forcers. Development of a new LTG related to mitigation and impact issues is underway. Mr. Croes said that other federal agencies also are exploring this air quality-climate nexus; how does the Global Change Research Program coordinate its work with other federal agencies? Dr. Costa said that the U.S. Global Change Research Program (USGCRP) coordinates and integrates climate change research across all federal agencies. There also is a Committee on Environmental and Natural Resources (CENR) that coordinates climate change work.

Dr. Amar asked if, in its CO₂ reduction goal setting, EPA is considering the effects that this may have on other pollutants. For example, if an 80 percent CO₂ reduction is required by 2050, this may solve the other PM and ozone standard issues. Dr. Scheraga said that EPA is just beginning to explore the co-benefits of its CO₂ policy. The Global Change Research Program is working closely with OAR to identify the most efficient policy scenarios.

Dr. Yarwood asked if the Global Change Research Program coordinates its internal work with that of the extramural researchers. Dr. Scheraga confirmed that it does.

Mr. Felton asked if alternative transportation strategies are being considered as a policy option. Dr. Scheraga said that this policy option is being considered.

Dr. Demerjian said that the global climate models vary greatly in their performance. Are these issues taken into account in the air quality predictions? Dr. Scheraga confirmed that these issues are taken into account. One of the limitations of the interim assessment is that the range of climate scenarios needed is not yet available. The Global Change Research Program is working to better understand why different models produce different results and feeding information back to the modelers to help them improve the models. The Program does not generate these global circulation model scenarios; instead, it relies on other federal agencies to generate these scenarios. The Global Change Research Program is not trying to make predictions; instead, the Program is trying to demonstrate that a risk exists, determine the magnitude of the risk in different parts of the country, and use that information to develop risk management strategies.

Cross-Program Discussion and Wrap-Up

ORD Air Program

Dr. Demerjian asked what OAR needs in terms of ORD's resource allocation between work to support the implementation portion of the air quality management activity versus work to improve on the standard setting process. Ms. Wegman responded that both are very important to OAR.

Dr. Levy asked if EPA, when determining key air pollution contributors, considers the effects of these determinations on the implementation of state management programs. Ms. Wegman said that after the key air pollution contributors are identified, the NAAQS will be revised to reflect this. There is not yet enough information to provide guidance to the states.

Dr. Demerjian asked about the status of EPA's program to develop air quality forecasting models. Dr. Schere explained that the work to develop an air quality forecasting system is now being performed in NOAA's Air Resources Laboratory; EPA continues to work with NOAA on this system, but plays more of a consultant role now. Ms. Wegman added that this work continues to be very important to OAR. Dr. Amar asked if the posters represented all of ORD's air-related research. Dr. Costa said that the posters are representative of the work, but do not cover all of the Program's work.

Dr. Demerjian asked why there is less work on methods development today than in the past. Dr. Costa replied that methods development work clearly is needed. Given the lack of resources, work must be prioritized and the methods development work often is seen as less of a priority. Dr. Demerjian asked if the Air Program has input into the Small Business Innovation Research (SBIR) methods development program. Dr. Costa said that he met with SBIR representatives recently. SBIR is encouraging methods development work, but they have not received many applications on these types of projects. Dr. Watkins agreed that this is a need that must be addressed. Currently, there are many missed opportunities for methods development in ongoing field work. The Air Program is working to better communicate with researchers about these opportunities. Ms. Wegman added that methods development is very important to OAR. Dr. Watkins has been very responsive to OAR's requests to move forward on methods development.

Dr. Demerjian thanked the speakers and poster presenters for their hard work in preparing the background materials and helping the Subcommittee understand the Program's work. It is clear that the Air Program researchers are at the top of their game.

Subcommittee Discussion

*Dr. Kenneth Demerjian, Atmospheric Sciences Research Center, Subcommittee Chair
BOSC Clean Air Subcommittee*

Dr. Henderson said that she was very impressed with the quality of the science in the Air Program. Dr. Tager said that there seemed to be a disconnect between the research being conducted and OAQPS' needs in terms of the multi-pollutant assessments. It is not clear how the source-to-health outcome work is meeting the needs of OAQPS. Dr. Levy agreed, adding that it is difficult to evaluate the relevance of the science across the multiple definitions of multi-pollutant. Dr. Henderson suggested noting this in the Subcommittee's report. Dr. Yarwood said that he was not sure that this was a relevance issue. The Air Program provides OAQPS with information on which pollutants are the most harmful, and OAQPS makes the policy decisions. Dr. Tager pointed out that the research under LTG 2 is supposed to reduce uncertainties about health effects. Health effects may or may not be found, depending on how multi-pollutant is defined. The magnitude of the health effects will need to be known to properly inform regulation decisions. He did not get a sense of how the data generated by the research will filter into the process it is supposed to support. Dr. Mittleman pointed out that the information is not there, so the problem with moving forward with a multi-pollutant approach is that it is not clear where it will lead. It is not clear that the work will ultimately lead to better health outcomes. Dr. Tager agreed and asked for feedback from the other Subcommittee members on this topic. Dr. Mittleman said that there still are many questions about the right approach to take. Should the work begin with studying sources or mixtures? Dr. Tager said that while it is possible to identify three pollutant sources, if there is overlap in the contribution of metals to those sources, the driving force behind a specific health outcome cannot necessarily be determined. Studying mixtures in different locations will not necessarily provide the correct answers because the populations in the locations inevitably will differ. Dr. Amar agreed that there seemed to be a disconnect between ORD and OAQPS with respect to the source-to-exposure paradigm and added that the CAA restrictions must be considered when the research is planned. Dr. Yarwood said that the Program should not be concerned about the CAA in the context of the multi-pollutant framework.

Mr. Felton said that he was disappointed that there was no long-term monitoring plan. Also, he has spoken with OAQPS researchers who do not think as highly of ORD's research as was depicted in the OAQPS presentation.

WEDNESDAY, JUNE 10, 2009

Subcommittee Working Session

BOSC Clean Air Subcommittee

Dr. Demerjian explained that the Subcommittee's report should be concise; the report will include a cover page, table of contents, executive summary, introduction and background, a section for each charge question, a summary and rating of each LTG that will include support for the rating and the Subcommittee's comments and/or recommendations, and a list of the Subcommittee members.

Dr. Demerjian read aloud the LTGs and the rating definitions. The Subcommittee will need to reach a consensus on a rating for each LTG. He will ask the Subcommittee members for their LTG ratings today; the hope is that the group can agree on the ratings. These are not the final ratings. After the draft report is compiled, each Subcommittee member will have a chance to read the full report. The Subcommittee will then discuss the report and come to a final consensus on the ratings and content of the report.

Dr. Demerjian asked each of the Charge Question Leads to give a synopsis of their group's section.

Charge Question 1 – Program Design and Demonstrated Leadership

Dr. Mittleman said that his group had yet to determine the writing section assignments. The group had no questions for the full Subcommittee.

Charge Question 2 – Scientific Quality

Dr. Henderson said that her group had met previously. She drafted some text that incorporated Dr. Yarwood's input. Dr. Levy has not yet written his section. The group still needs to review the Air Program's publications and reports and needs to add some text on the market survey.

In response to a question from Dr. Henderson, Dr. Demerjian clarified that the response to the charge question should cover how well the science quality supports the achievement of the LTGs, but does not need to include a ranking; each LTG will be ranked separately later in the report. The text for each charge question should, however, ultimately support the LTG rankings. Dr. Henderson said that, overall, the quality of the science in support of LTG 1 is exceptional.

Charge Question 3 – Relevance

Dr. Tager said that without a clear multi-pollutant definition, starting with sources is appropriate. It is important that the Clean Air Research Program produce the data that will be needed to support regulation. The low response rate for the client survey made it difficult to gauge client views of the Program, but the presentations indicated that the clients were very happy with the output of the Air Program.

Charge Question 4 – Demonstrated Outcomes

Dr. Amar said that he felt that the air quality portion of the work met expectations.

Dr. Demerjian asked if the Subcommittee members wanted to include any recommendations on revising the LTGs in the report. Dr. Branch said that he was unclear on how reducing uncertainty could be quantified. Dr. Demerjian explained that conducting more health outcomes research will improve understanding and ultimately reduce uncertainty about the relationship between exposure and health

outcomes. The major distinction between LTG 1 and LTG 2 is that LTG 1 is focused on generating data to support air quality standards for protecting human health, while LTG 2 is focused on the potential for taking a different approach, which currently is source-to-health. There also is the question of balance in the Program. He asked the Subcommittee members for their thoughts on the balance between health research on ozone, PM, and air toxics. Dr. Levy said that there was not enough air toxics research. Dr. Amar pointed out that the Clean Air Research Program's structure ensured that air toxics were driven by technology, while ozone and PM were more science driven. Mr. Felton proposed that the Subcommittee suggest a minor shift in resource allocation to provide more resources for ozone and air toxics work. Dr. Demerjian said that this could be included in the report's conclusions and recommendations section.

The Subcommittee members decided to meet in their workgroups for the next half hour.

Workgroup Meetings

Subcommittee Working Session (continued)

BOSC Clean Air Subcommittee

Dr. Mittleman asked how the budget is allocated across the different parts of the Clean Air Research Program. Dr. Costa explained that the extramural budget, which includes STAR grants, is approximately \$16 million, but he was unsure of the intramural budget. The budgeting process changed approximately 2 years ago, and this resulted in a major shift of resources to infrastructure support, making it more difficult to allocate money to the laboratories. Of the \$16 million in extramural funding, \$8 million per year goes to support the PM Centers, \$4 to 5 million per year is allocated to health research, and \$4 to 5 million per year is allocated to atmospheric science. HEI funding is separate; HEI receives approximately \$1.6 million per year from the Clean Air Research Program and approximately \$1.5 million per year from OAQPS. Dr. Costa said that currently about 60 percent of the budget is allocated to source-to-health outcomes and 40 percent to health, exposure, and air quality. It is expected that this will reverse in the next few years. Dr. Costa added that he does not have budget authority, only budget responsibility. The budget for the Clean Air Research Program has been relatively flat over the years (not taking inflation into consideration). Extramural support has been relatively flat over the years as well. Last year, \$1 million was taken out of the STAR grants to support the near-road research. Dr. Costa added that of the total \$80 million in funding per year, only \$12 million is allocated to research support. In response to a question from Dr. Demerjian, Dr. Costa confirmed that the 2005 BOSC Report suggested a focus on source-to-health outcome.

Mr. Felton asked if EPA researchers outside of ORD conduct research. Dr. Costa said that research is conducted in the regions. Mr. Felton asked if there are any incentives for ORD researchers to become mentors for RARE grants. Dr. Costa replied that there is no major incentive beyond publishing journal articles from the work. The RARE grant funding comes from ORD, but the Air Program also provides some support as a researcher's time is spent working on the project. Over the past few years, there has been more effort put toward connecting ORD and the regions.

Dr. Amar asked how the NPDs operate within ORD. Dr. Costa responded that the NPD positions were created to coordinate research in a specific topic area across the different ORD laboratories. Initially, NPDs were given budget authority. Currently, NPDs have budget responsibility but not budget authority. Mr. Felton asked if the Air Program has its own dynamometers. Dr. Costa said that the Program does, with some operational and others not (due to resource limitations).

Mr. Croes asked how decisions are made in terms of allocating resources to the different issues (i.e., PM, ozone, air toxics). Dr. Costa responded that decisions are made by consensus, with a number of people and offices having input on the budget allocations. Issues are prioritized based on the needs and resources available. PM continues to be a major driver. Dr. Devlin added that ozone will become more of a focus in

the next few years. Mr. Felton said that he understood that there are many research needs and limited resources, but it appears that some stakeholder's needs receive more funding than others. Is there a way to make the allocation more equitable? Dr. Costa stated that when inflation is taken into account, the Air Program's budget has decreased about 40 percent over the past 8 years. Given the limited resources, they do what they can for the more neglected issues.

Dr. Demerjian said that next the Subcommittee would discuss the LTGs and the work assignments. Dr. Levy and Mr. Croes are leading the LTG 1 summary assessment, and Dr. Tager is leading the LTG 2 summary assessment. Dr. Demerjian asked the Subcommittee members to include any specific recommendations for the Program as bullets in their sections. The Subcommittee members indicated that they understood their assignments. Ms. Kowalski explained that, to comply with FACA, the Subcommittee members could distribute written sections within their workgroups, but not to the entire Subcommittee. She suggested that the Subcommittee members work within their workgroups to draft their sections and then send those sections to Dr. Demerjian who will then compile the sections. The Subcommittee can then discuss the text on the next public conference call. If Subcommittee members need to send their materials to other members outside of their workgroups, they should send those materials to Ms. Kowalski, who will distribute them. She noted that the Subcommittee members can send individual comments to her and Dr. Demerjian, but not to the entire Subcommittee. Dr. Demerjian asked that the written sections be sent to him in the next 2 weeks. The Subcommittee tentatively scheduled the next conference call for Monday, July 27, 2009, from 1:00 p.m. to 3:00 p.m. Eastern Standard Time.

Debrief/Oral Report on Charge Questions

*Dr. Kenneth Demerjian, Atmospheric Sciences Research Center, Subcommittee Chair
BOSC Clean Air Subcommittee*

Dr. Mittleman said that the Air Program Leadership overall is very impressive. There seems to be strong leadership and integration across the different aspects of the Program. There are, however, some gaps in terms of Program direction (e.g., coverage of air toxics, etc.). The other Subcommittee members agreed with this assessment.

Dr. Henderson said that the science quality is excellent. The researchers collaborate and leverage resources with researchers both within and outside of EPA. The extramural research is excellent and the reputation of the Program around the world is outstanding. She would rank the science quality as exceptional. The other Subcommittee members agreed with this assessment.

Dr. Tager said the research being conducted is relevant. The use of the near-road model to test the multi-pollutant paradigm is appropriate. It is clear from the presentations that the research is being used by others.

Dr. Amar said that the Program has made significant progress in its research in terms of answering key science questions related to public health benefits and pollution abatement. The Detroit study is moving in the right direction by studying exposure in a multi-pollutant environment. In terms of air quality, substantial progress has been made in CMAQ development. Overall, the Program's work is on the right track.

Dr. Demerjian said that overall the Subcommittee is quite impressed with the Air Program's work. The material presented at this meeting and on the conference calls has helped the Subcommittee to understand the Program better. The Subcommittee's report will be favorable and will include more detail to support this conclusion.

Dr. Costa thanked the Subcommittee members for investing their time in this review. The Subcommittee has a diverse array of expertise that will produce a helpful assessment.

Dr. Demerjian thanked everyone for their participation and adjourned the meeting at 11:22 a.m.

Action Items

- ✧ Subcommittee members will send their written assessments to Dr. Demerjian within 2 weeks.
- ✧ Dr. Demerjian will compile the sections and distribute the draft report to the Subcommittee members.
- ✧ The Subcommittee will have a conference call, tentatively scheduled for Monday, July 27, 2009, from 1:00 to 3:00 p.m., to discuss the draft report.

All materials that were transmitted during
and for this meeting are in the public meeting
binder in the BOSC central files in
Washington, DC.

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Clean Air Research Program Subcommittee
DRAFT MEETING AGENDA
June 8 - 10, 2009**

**Environmental Protection Agency
109 T.W. Alexander Drive, Research Triangle Park, NC 27711**

Monday, June 8, 2009 (Room C111 B/C)

11:00-11:30 a.m.	Registration	
11:30-11:45 a.m.	Welcome, Introductions, & Opening Remarks	Dr. Ken Demerjian BOSC Clean Air Subcommittee Chair
11:45-11:50 a.m.	DFO Welcome and Charge - Administrative Procedures & FACA Rules - Objective of this Subcommittee & Charge	Lori Kowalski (EPA/ORD)
11:50-12:00 p.m.	ORD's Welcome	Dr. Larry Reiter Acting Deputy Assistant Administrator for Management (EPA/ORD)
12:00-12:15 p.m.	Break to Get Lunch From Cafeteria	
--WORKING LUNCH--		
12:15-12:35 p.m.	Welcome & Synopsis of ORD's Air Program	Dr. Dan Costa (EPA/ORD) National Program Director (NPD) for Air
12:35-12:55 p.m.	Discussion of General Program Issues	Dr. Dan Costa, NPD for Air (EPA/ORD)
12:55-1:15 p.m.	General Program Questions	Dr. Ken Demerjian & BOSC Clean Air Subcommittee
<u>Session 1: Health and Exposure Research</u>		
1:15-1:45 p.m.	Synopsis/Orientation	Dr. Robert Devlin (ORD)
1:45 -3:15 p.m.	Poster Session (Atrium)	BOSC Clean Air Subcommittee



3:15-3:30 p.m.	Break	
3:30-4:15 p.m.	Discussion	Presenters & BOSC Clean Air Subcommittee
4:15-4:30 p.m.	OAQPS Perspective	Lydia Wegman, Director Health & Environmental Impacts Division (EPA/OAR)
4:30-4:45 p.m.	Public Health Perspective	Dr. Michael McGeehin (CDC)
4:45-5:00 p.m.	Human Health Research Program Coordination	Dr. Sally Darney, Acting NPD Human Health (EPA/ORD)
5:00 p.m.	Adjourn	

Tuesday, June 9, 2009 (Room C-111 B/C)

8:00-8:45 a.m.	Review of Yesterday's Activities Overview of Today's Agenda Discussion	Dr. Ken Demerjian & BOSC Clean Air Subcommittee
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Session 2: Air Quality Management

8:45-9:00 a.m.	Synopsis/Orientation	Mr. Ken Schere (EPA/ORD)
9:00-10:00 a.m.	Poster Session (Atrium)	BOSC Clean Air Subcommittee
10:00-10:15 a.m.	Break	
10:15-11:00 a.m.	Discussion	Presenters & BOSC Clean Air Subcommittee
11:00-11:15 a.m.	State Perspective	Michael Gilroy, Manager Meteorological & Tech Services Puget Sound Clean Air Agency
11:15-11:45 a.m.	Lunch	
11:45-12:30 p.m.	Discussion	BOSC Clean Air Subcommittee



Session 3: Source-to-Health Outcome: Multi-Pollutant

12:30-12:50 p.m.	Synopsis/Orientation	Dr. Alan Vette (EPA/ORD)
12:50-2:20 p.m.	Poster Session (Atrium)	BOSC Clean Air Subcommittee
2:20-3:00 p.m.	Discussion	Presenters & BOSC Clean Air Subcommittee
3:00-3:30 p.m.	Q/A With PM Center Directors	Dr. Ken Demerjian & BOSC Clean Air Subcommittee
3:30-3:40 p.m.	Public Comment	
3:40-4:00 p.m.	Global Climate Program Coordination	Dr. Joel Scheraga, NPD for Global Change (EPA/ORD)
4:00-4:30 p.m.	Cross-Program Discussion and Wrap-Up	Air Program ORD
4:30-5:00 p.m.	Discussion	BOSC Clean Air Subcommittee
5:00 p.m.	Adjourn	

Wednesday, June 10, 2009 (Room C-111 B/C)

8:00-8:10 a.m.	Review of Yesterday's Activities	Dr. Ken Demerjian BOSC Clean Air Subcommittee Chair
8:10-10:30 a.m.	Work Session	BOSC Clean Air Subcommittee
10:30-10:45 a.m.	Break	
10:45-11:15 a.m.	Debrief Oral Report on Charge Questions	Dr. Ken Demerjian & BOSC Clean Air Subcommittee
11:15 a.m.	Adjourn	