

**U.S. Environmental Protection Agency
BOARD OF SCIENTIFIC COUNSELORS
Particulate Matter/Ozone Program Subcommittee Meeting Summary**

**U.S. Environmental Protection Agency
Research Triangle Park, North Carolina
March 30–31, 2005**

WEDNESDAY, MARCH 30, 2005

Welcome and Opening Remarks

Dr. Rogene Henderson, Scientist Emeritus, Lovelace Respiratory Research Institute

The meeting was called to order at 8:20 a.m. by Dr. Rogene Henderson, the Chair of the Particulate Matter (PM)/Ozone Program Subcommittee. She welcomed the subcommittee members and thanked the EPA staff for their time and effort in preparing a very impressive set of materials for the meeting. She then introduced the subcommittee members, beginning with the co-chair, Dr. Juarine Stewart, and the other subcommittee members, Drs. Charles Rodes, Christian Seigneur, and Peipei Ping and Mr. Bart Croes and informed the participants that Dr. Kenneth Demerjian would be joining them shortly. She also informed the participants that subcommittee members Drs. Brian Lamb and Michael Lipsett could not attend in person, but would be joining the meeting via telephone. She concluded the welcome by introducing Mr. Lawrence Martin, the Designated Federal Officer (DFO) for the PM/Ozone Subcommittee.

DFO Welcome and Charge

Mr. Lawrence Martin, DFO, Office of Science Policy (OSP), Office of Research and Development (ORD), U.S. Environmental Protection Agency (EPA)

Mr. Martin welcomed and thanked the subcommittee members for their work to date and their ongoing efforts on behalf of the Board of Scientific Counselors (BOSC). He reviewed the administrative procedures and Federal Advisory Committee Act (FACA) rules pertaining to the BOSC public meetings, briefly explained the charge to the subcommittee, and discussed the basic roles of the subcommittee members and the BOSC Executive Committee. As DFO, Mr. Martin's role is to serve as liaison between the subcommittee and EPA. He briefly discussed the objectives and general responsibilities of the subcommittee members and EPA staff and presented information on meeting protocol and procedures. He closed by informing participants that the meeting was being recorded, and asked all persons making comments or asking questions to use the microphones provided and to identify themselves, for the record, before speaking.

Office of Research and Development Welcome

*Dr. William Farland, Acting Deputy Assistant Administrator for Science, ORD, EPA
Presented by Dr. Lawrence Reiter, Director, National Health and Environmental Effects
Research Laboratory (NHEERL), ORD, EPA*

Because Dr. Farland was unable to attend the meeting, Dr. Lawrence Reiter welcomed the participants on behalf of the Office of Research Development (ORD) and thanked the subcommittee members for their work on the review of the PM/ozone research program. His presentation included background

information on the need for external review of the research program, ORD's expectations regarding the review, and an overview of the meeting's agenda.

Dr. Reiter said that ORD's commitment to an external review of its research programs was reinforced by the National Academy of Sciences (NAS) and the Office of Management and Budget (OMB). ORD uses external review to develop its strategic plans, multi-year plans (MYPs), and laboratory implementation plans. He noted that NAS has recommended independent expert review for evaluation of federal research programs and that recommendations from an independent expert review offer guidance to federal agencies. Dr. Reiter stated that review results are published in peer-reviewed literature and they can influence the budget process. He informed participants that implementation of the Program Assessment Rating Tool (PART) process by OMB has increased the importance of these reviews. ORD asked the BOSC to participate in the review of its scientific programs and to examine whether the results produced by programs are addressing Agency problems. The reviews focus on the quality, relevance, and priorities of research, accountability, and the current and expected impact of the science. These areas mesh well with the evaluation criteria developed by OMB and the Office of Science and Technology Policy (OSTP). In addition, OMB and OSTP encourage research managers to characterize scientific leadership as part of the review. The charge questions for this program review elaborate on how the program is addressing these areas.

Dr. Reiter explained that the format of the review process and the agenda consist of overview presentations, poster sessions, and discussions. He said that the overview presentations would provide the context for research, outline the major scientific questions being addressed, and highlight key findings. Each overview would be followed by a poster session that will offer detailed descriptions of research. He made special mention of the fact that posters for this meeting are not like those seen at other scientific meetings. They are meant to address central questions across intramural and extramural programs. Several PM Center and Science To Achieve Results (STAR) scientists will be presenting posters featuring research in which they participated. Some members of the research client staffs also will serve as presenters. After the poster sessions, there will be opportunities for the subcommittee members to talk with the scientists to clarify any issues so that those facts can be incorporated into the subcommittee's report. Following the poster sessions, the program and regional office representatives will describe how the research has been responsive to their overall needs and provide the science perspective on the program's responsiveness.

Overview of ORD's Air Program

Dr. Daniel Costa National Program Director for Air, ORD, EPA

Dr. Costa thanked the subcommittee members, Associate Laboratory Directors, and Center Directors for taking the time and effort to prepare for and participate in the review, and he thanked the administrative staff for their help in compiling the plethora of materials to support the meeting.

To open his presentation, Dr. Costa stated that the Air Program is changing. In the most recent PART Review, it was noted that many things were done well, but some elements were lacking, specifically the areas of accountability and results. This was determined because results that EPA staff members perceive as outcomes, OMB interpreted as outputs. OMB defines outcomes as the real benefits attributable to the results as they are implemented in society.

The primary function of ORD is to provide the foundation for EPA decision-making. The PM/Ozone Research Program offers a unique degree of integration across intramural programs and has significant regulatory benefits and impacts for public health. Benefits to health have been realized from air pollution reduction, and OMB has quantified these changes in terms of the billions saved on health care costs over the 1992-2002 decade. What is expected of the subcommittee today is an objective, expert assessment of the PM/Ozone Research Program. This assessment has become a "data challenge" based on OMB

requirements to show the benefits of ORD's research programs. We have restructured the program to show outcomes and address some long-term goals to help structure the program.

Dr. Costa reviewed the many changes and advances related to research on PM/ozone exposure, using 1997 as the base year for comparison and the 1998 PM Program Directive and mandate derived from EPA's 1998 budget increase. Since 1998, four *NRC Reports on Research Priorities for Airborne Particulate Matter* have identified important research gaps and needs, and recommended establishment of high-priority, multi-year research projects to address them. The 10 research priorities for air quality cited by the reports emphasized the reduction of health risks and shaped the current research program components, which are: Intramural Program; EPA STAR Program (PM Centers); Emission Source Characterization; Exposure, Atmospheric Measurement, and Model; EPA Partners; and Supersites and the EPA Monitoring Network. These components set the stage for multi-year planning and coordination. The long separated PM and ozone research programs have been combined under the "one atmosphere" theme that is implicit in epidemiology and toxicology-based research pertaining to air pollutants.

Dr. Costa stated that a primary focus of this meeting is to inform the PM/Ozone Research Program that all research henceforth must demonstrate health-related impact and show quantifiable outcomes to justify the budget to both OMB and Congress. To that end, the program is being redesigned in an outcome-oriented manner, complete with two well-linked, outcome-oriented long-term goals (LTGs) that represent the core activities of the air programs. Integration of the LTGs will result in better air quality, internal program improvements, improved efficiencies, and, ultimately, improved public health. Dr. Costa then described some of the recent accomplishments in PM/Ozone programs, presenting evidence in the areas of outcome-oriented program design, science leadership, science quality, and relevance. He urged all involved to strive to develop additional evidence through their current work.

Dr. Costa's data on the resource base for the PM Program brought to light some of the staffing and budget related obstacles that challenge efforts to redesign the program and cited the changing climate imposed by the Government Performance and Results Act (GPRA) and OMB's PART process as additional challenges to program evolution. Again, he stressed that the interpretation of accountability requires PM programs to prove that they have an impact and an outcome. The program evolution challenge means: moving toward the "one-atmosphere" concept, but doing so step-by-step; expanding issues and needs; and responding to rapidly changing technologies with flexibility to avoid lagging 2-3 years behind.

Determination of the program's future direction is based on National Research Council (NRC) recommendations. Dr. Costa suggested that responsive program management requires the program staff to solidify the commitment to advance interdisciplinary work through partnerships with public and private organizations. Development of a systematic approach to addressing the issue of hazardous components can be achieved by targeting regulatory activity using a multi-city, multi-hazard approach. Assessment of the long-term health impacts of PM can be seen in results from current prospective and retrospective epidemiology studies. Additional support for the Office of Air and Radiation (OAR) entails tool and methods development and accountability research. Broadening the PM/Ozone Program to fully incorporate the "one atmosphere" issue and expanding long-term air quality goals must be addressed with a diversified approach focused on health and human effects.

In closing, Dr. Costa looked at the PM investment in perspective by offering the following comparison:

- ✧ In 2003, Americans spent approximately \$1.5 billion per day for electricity and gasoline and diesel fuel for driving.
- ✧ In the past 7 years, the investment in PM and ozone research amounts to less than a quarter of that amount or roughly, 1/10,000 of American energy expenditures.

He went on to posit that in spite of what appears to be a minimal investment, EPA sees the payoff from this investment as substantial. Regarding the relevance of the issue, on Friday, March 25, 2005, a feature article in *Science Magazine* reported that the public still considers the PM issue to be important.

Discussion of General Program Issues

Dr. Daniel Costa National Program Director for Air, ORD, EPA

Dr. Henderson asked about who sets the program's research priorities and whether this group constructs the MYP. Dr. Costa replied that a committee composed of persons representing different offices within EPA, grant offices, stakeholders, and clients establish the research priorities. This committee also is responsible for devising the MYP. Dr. Henderson followed up by asking when the plan would be ready. Dr. Costa said that the MYP for 2006 is completed and work on other plans is ongoing.

Regarding regional representation and the process of obtaining information on regional and state needs, Dr. Lipsett asked how information reaches the committee that establishes the research priorities. Dr. Costa said that such information is communicated through regional leaders and other representatives.

Dr. Ping asked about the funding status of the PM Centers. Dr. Costa said the Centers are funded independently. A new Request for Applications (RFA), reflecting new thinking in areas such as interdisciplinary research, is in process.

Mr. Croes commented that projections for research funding do not show any separate funding for ozone research and he asked whether there were plans for research in that area. Dr. Costa indicated that the program shift toward the "one atmosphere" concept includes ozone research.

Dr. Demerjian raised the issue of reduced resources and the subsequent affects such reductions have on the monitoring process and monitoring programs, asking how the issue might be addressed. Dr. Costa responded that certain things could be done to adjust to the declining budget, including showing the relationship of monitoring to health issues. He acknowledged that this area needs to be addressed more thoroughly.

Mr. Croes noted that some program outcomes do not have directly measurable health cost implications, for example, reducing child asthma, and asked how such outcomes would be valued. Dr. Costa said issues like this would need to be addressed by the programs involved. Dr. Miller added that such outcomes are included in the overall measurement of health costs and benefits implicitly. Dr. Kuzak agreed and said discussions about what areas need more evaluation research attention are in progress and also will encompass planning for higher prioritization of those area and valuation mechanisms.

Session 1: National Ambient Air Quality Standards (NAAQS) Health and Exposure Research

Overview: Health and Exposure

Dr. Robert Devlin, NHEERL, ORD, EPA

To set the stage for the first poster session, Dr. Devlin reminded the participants that the health and exposure program is unique because it was created as an integrated program involving EPA and extramural grantees since its inception. To trace the progress of PM health and exposure research over the past 7 years (1997-2004), Dr. Devlin began the presentation with an overview of research data and information on PM health and exposure, starting with the basic issues comprising the state of the science in 1997, which then were compared with current NRC research priorities for airborne particulate matter.

In 1997, approximately 30 epidemiology studies worldwide reported similar associations between ambient PM and cardiac mortality and morbidity. What they did not address was the fact that the chemical make-up of PM differs from city to city and fluctuates at different times of the year. At the time, PM levels were very low compared with other particle exposures and no widely accepted process or mechanism existed to explain how a person could die from an acute exposure to such low levels of air pollution particles. Currently, NRC has specified 11 research priorities for airborne particulate matter. The health and exposure poster session is designed to answer four broad questions that are a subset of the NRC research priorities. Those questions are: (1) What are the PM components responsible for these effects? (2) Who is susceptible to PM? (3) How does PM cause adverse health effects? and (4) What are the effects of long-term exposure to PM?

Through discussion of the findings from the studies outlined in the health and exposure research posters, Dr. Devlin walked through the research history pertaining to each question, showing progress in achievement and understanding of research findings and discussing how the escalating knowledge base shaped and affected the complexity of subsequent research. He followed the walk-through with a summary of key findings for each of the four questions.

1. Key research findings addressing the first question showed that virtually all PM components cause adverse health effects. Dr. Devlin said that this finding might explain why epidemiology studies conducted in different places at different times showed many of the same effects.
2. For Question 2, key research findings confirmed known susceptible populations previously identified by epidemiology studies, uncovered new populations by expanding the study to include all respiratory and other diseases, examined the role of genomics in susceptibility to PM, and ruled out behavior patterns as factors for susceptibility.
3. Key findings in mechanistic research (Question 3) established biological plausibility, improved understanding of the physiological mechanisms adversely affecting health, and formed the basis for understanding some of the “whys” (i.e., the genetic and molecular processes that control response to PM).
4. Retrospective and longitudinal studies address Question 4, offering key findings data on the long-term effects of PM exposure.

After acknowledging that much more work must be done in the area of health and exposure research, Dr. Devlin expressed hope that following the poster session, participants would be convinced that the quality of the science done to date is excellent. He then spoke about the multiple impacts—experienced within and across EPA—that have been realized from studies conducted during the 7-year research period. To illustrate one of the most public impacts of PM research, he offered the example of the color-coded Air Quality Index (AQI) for ozone, a measure that is referred to by weather forecasters constantly, and one that is well known by the public. He explained that ORD scientists have been working with OAR to educate the population on the effects of air pollution and that a similar chart for PM is in progress.

In closing, Dr. Devlin reaffirmed that air pollution health and exposure research has produced significant benefits and impacts that demonstrate the need for standards to protect public health and strengthen confidence in the scientific basis for these standards. This research also has served to inform the public, particularly at-risk populations, of the harmful effects of air pollutants and to educate them to minimize exposure to air pollutants.

Dr. Henderson thanked Dr. Devlin for his thorough presentation and described the procedures for reviewing the posters before releasing participants to attend the poster session. Drs. Costa and Devlin added information on the overall arrangement of Session 1 posters and the configuration of areas under each of the four broad topics. Poster Session 1 was devoted to Health and Exposure Research.

Poster Session 1

Poster Session 1 was held in the Atrium area of the building. The subcommittee reviewed 21 posters in this session. Before the meeting, Dr. Henderson assigned each subcommittee member three to seven posters to review and evaluate thoroughly. 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.

Discussion of Poster Session 1

The large number of posters to be reviewed for this session did not permit in depth discussion of each. For the open discussion following the poster session, Dr. Henderson had asked subcommittee members to summarize, in one or two sentences, the main points made in each poster. This method offered all subcommittee members the opportunity to obtain general impressions of the posters he or she had not reviewed personally. With the assistance of background and supporting materials, the subcommittee members attending the meeting by telephone participated in all aspects of the poster session, including discussion of their assigned posters with the presenter(s) and the open discussion following the poster session. Drs. Ping, Rodes, Stewart, and Lipsett and Mr. Croes tendered comments on their assigned posters. The majority of comments on Session 1 posters were positive and some were laudatory. Dr. Rodes commented that anticipatory research had not been addressed by most of the researchers and asked that this omission be reflected in the subcommittee's report. A few other comments were confined to minor issues or omissions noted by subcommittee members. Overall, the members found the posters to be the most informative of the meeting's supporting materials. Complete evaluative commentary on posters will be incorporated into the subcommittee's report on the program review of the PM/Ozone Research Program.

Working Lunch

Subcommittee Members

During lunch, the subcommittee members discussed their report writing assignments. Previously, Dr. Henderson had assigned writing responsibility for each of the four charge questions to two subcommittee members. The report section addressing the charge question on Program Design and Demonstrated Leadership was assigned to Drs. Demerjian and Lamb. The report section addressing the charge question on Science Quality was assigned to Drs. Henderson and Ping. The report section addressing the charge question on Relevance was assigned to Drs. Rodes and Lipsett. The report section addressing the charge question on Demonstrated Outcomes was assigned to Dr. Seigneur and Mr. Croes. Each subcommittee member confirmed completion of preliminary work on their respective report sections and shared copies of those drafts with the entire subcommittee. Dr. Henderson clarified points related to the length and detail required for each section. The members discussed the level of detail required, and agreed to develop section drafts for distribution and review among subcommittee members by the following morning (Thursday, March 31). Dr. Henderson requested section drafts of 5-8 single-spaced pages, including any questions that needed to be addressed. She reminded the subcommittee members that they should feel free to submit questions or comments on sections not assigned to them to the members assigned to those sections. She also asked whether the members needed any additional information.

Several questions about EPA funding priorities were raised during the working lunch. Dr. Henderson obtained agreement from the subcommittee to set aside time for answering these questions following Dr. Vickery's presentation and before Poster Session 3 on Thursday, if needed.

After participants returned from the lunch break, Dr. Henderson introduced Dr. James Vickery.

Session 2: Air Quality Management Presentation – Overview

James Vickery, NERL, ORD, EPA

Dr. Vickery was tasked with providing the foundation for the review of posters addressing air quality management. His focus was integration of research across the PM science paradigm. He began his presentation with an overview of research data and information on PM air quality management, starting with the basic issues comprising the state of the science in 1998.

In 1998, there was an overall need for additional air quality research to characterize air pollution sources and atmospheric processes, to inform exposure and health studies, and to support planning and implementation. Measurement methods, in particular, were inadequate, the understanding of PM chemistry was limited, research models were simplified, and emissions characterization was inaccurate. The Agency lacked ambient methods to monitor all important size fractions, species, and precursors. Although Federal Reference Methods (FRMs) were established, they were not fielded or fully challenged, and PM speciation was not well known in the United States.

Dr. Vickery reported that since 1998, accomplishments and insights into air quality management have included fielding and evaluating the PM_{2.5} FRM and conducting field tests on the PM coarse FRM. He noted that the Rochester and Southern California Supersites had developed methods and routinely measured the mass and number of ultrafine PM. He also said that Dr. Solomon's poster shows work in this area. In the area of understanding, categorizing and classifying the environment, a partnership with OAR spawned the development of seven EPA PM Supersites, which have operated for the past 5 years. Dr. Vickery said these programs are wrapping up their work and releasing publications that document their results. They have identified new methods, including continuous methods and single particle analyzers. For example, in 2001–2002, five eastern sites conducted comprehensive seasonal studies identifying seasonal and urban/rural differences in nitrates. Study representatives presented these results at the American Association for Aerosol Research (AAAR) Atlanta Specialty Conference in February 2005. The five eastern sites also have merged their individual data into a comprehensive data set. Insight from the aggregate data facilitates scientist's understanding of east-west speciation differences. Dr. Vickery mentioned that Dr. Jones' poster shows results of this study. The results of the Supersites program are very interesting and should provide information for a long time. These results need to be published and incorporated into the Regional Planning Organizations/State Implementation Plan (RPO/SIP) process to help develop more cost-effective controls.

Data on future research directions and outcomes for ambient methods and observations can be gleaned from the posters submitted by Drs. Solomon and Vanderpool, who address continuous and semi-continuous Federal Reference Methods/Federal Equivalency Methods (FRM/FEM) and Dr. Jimenez, who presents results from eight of the STAR grants.

Dr. Vickery stated that the topic of emission characterization presents three specific challenges: (1) producing source profiles for models and studies, (2) finding a reasonable approach for developing a state partnership, and (3) balancing inventory and characterization needs.

Dr. Kimbrough's poster speaks to these challenges. Substantial inroads have been made for conventional and unconventional sources.

The Dilution Sampling System now fully characterizes many source categories including residential oil-fired furnaces, large coal-fired utility boilers, and commercial jet aircraft engines (Dr. Hayes' poster). Dr. Baldorf's poster presents results from the update of the speciate database. There also are improved means for characterizing biomass burning using remote sensing techniques to identify fires. Another exciting development in emission characterization is the vertical radial plume mapping method (VRPM), which monitors nitrate emissions from hog barns and lagoons. Dr. Harris' poster highlights this study. Through an industry partnership, data on fine PM are being captured from coal-fired power plants. Dr. Miller has done work in this area.

Future research directions in emission characterization should come from work arising from the North American Research Strategy for Tropospheric Ozone (NARSTO) Commission recommendations. In the area of source emissions, satellite imagery is the future. This is the topic of Dr. Russell's poster.

Regarding the state of air quality processes and modeling, chemical process understanding is very uneven. Some processes are very well known, but poorly understood. Primarily, there is a lack of field data necessary to fully evaluate receptor-oriented models. Accomplishments in air quality processes and modeling include continued development of a PM chemistry module of secondary organic aerosols and the Southern California Particle Center and Supersite's work on characterizing fine and ultrafine PM. Source oriented models for ozone are presented in Dr. Shere's poster. Source oriented models for PM studies are the focus of Dr. Gilliland's poster. It should be noted that this work is being done in partnership with the Department of Energy. Dr. Eberly has a poster outlining a study of receptor modeling results for four urban areas. Dr. Hayes' poster addresses radiocarbon measurements related to wood smoke.

The future direction in air quality processes and modeling is toward the 12 STAR grants that are evaluating ways to improve receptor models; integrating receptor, source-based, and inverse modeling; improving methods for molecular tracers and identifying new tracers; and developing a next generation receptor model. EPA has placed a major investment in these grants. An independent evaluation of them is ongoing, which Dr. Eberly will discuss in the poster session

The top 10 outcomes anticipated for air quality and processes involve fully and continuously characterizing the atmosphere and relevant pollutant species for: (1) compliance and accountability; (2) fundamental process understanding; (3) all important sources; (4) all spatial and temporal scales including a full process understanding of the chemistry of PM represented in models; (5) all pollutants, co-pollutants, and mixtures; (6) future and real-time projection; (7) accountability to the completely integrated science paradigm; (8) source/ climate interaction; (9) source/exposure/effect related to the health continuum; and (10) source/deposition/effect related to the ecological continuum. ORD is producing the toolbox envisioned by both of the NRC reports on air quality management and improvement, PM research priorities, the Clean Air Act Advisory Committee (CAAAC) recommendations, and the North American Research Strategy for Tropospheric Ozone (NARSTO).

Questions and Comments

Dr. Lipsett asked whether there is an effort to develop acceptable levels of uncertainty regarding health outcomes. Dr. Vickery replied that there is an entire body of uncertainty science and several ongoing studies, but nothing current on uncertainty framework.

Dr. Demerjian commented that those in charge of investing research dollars have missed the need for speciation studies. It is not clear that any sustained program addresses the need for a 2–3 year study. He then asked how studies are identified and prioritized. Dr. Vickery said that there is a program to look at methods research, but it ebbs and flows as the emphasis changes based on recommendations from the governing committee.

Dr. Henderson asked whether the people concerned with health effects are viewed as customers or clients for research. Dr. Vickery responded that they are considered collaborators.

Poster Session 2

Poster Session 2, held in the Atrium area of the building, included 17 posters. Before the meeting, Dr. Henderson assigned each subcommittee member 3 to 7 posters to review and evaluate thoroughly.

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.

Discussion of Poster Session 2

Subcommittee Members

The large number of posters reviewed for this session did not permit in depth discussion of each. For the open discussion following the poster session, Dr. Henderson asked subcommittee members to briefly summarize the main points made in each poster reviewed. Drs. Henderson and Costa added that the poster discussion should be framed in terms of the importance to the outcome of air quality issues addressed by the research findings. This method offered all subcommittee members the opportunity to obtain general impressions of the posters he or she had not reviewed personally. With the assistance of background and supporting materials, subcommittee members attending the meeting by telephone participated in all aspects of the poster session, including discussion of their assigned posters with the presenter(s) and the open discussion following the poster session. Drs. Demerjian, Seigneur, and Lamb and Mr. Croes discussed the posters they had reviewed. The majority of comments on Session 2 posters were positive. Overall, the members found the posters to be informative, the research impressive, and the progress toward the goals to be positive. Complete evaluative commentary on the posters will be incorporated into the subcommittee's report on the program review of the PM/Ozone Research Program.

Questions

As requested following the morning presentations, Dr. Henderson turned the participants' attention to a few questions of interest that had arisen over the course of the day.

Directing the question to Dr. Costa, Dr. Henderson asked whether internal funding could be distributed competitively across the research community that works on PM issues. Dr. Costa answered "yes and no," stating that programs are highly directed and prioritized. Generally, the research community wants work conducted in certain areas. ORD tends to fund diversity and focus competition on current needs, the need to develop products, and experience in product development. The uncertainty of research dollars changes the approach to funding every year.

Dr. Rodes, who is working on PM coarse particles with Dr. Lipsett, asked how ORD looks at the topic of PM coarse speciate variability to obtain meaningful data. Dr. Vickery offered a partial answer stating that OAR has asked ORD for input on the subject. Dr. Demerjian suggested that ORD set up a demonstration project to address the kinds of data that need to be generated by the research. Dr. Vickery agreed from a strategic planning point of view, but added that realities control funding.

Working Session

Subcommittee Members

In a closed working session on Wednesday afternoon, the subcommittee discussed details for completing their evaluation reports and schedule changes to enable the meeting to end on Thursday, March 31 instead of Friday, April 1. They also discussed the specific logistics and timing for the following day (Thursday, March 31) and for the period following the meeting and leading up to submission of their draft evaluation report. Specific elements of the report were discussed, such as length, format, means of incorporating health measures, and consolidation and review of all report segments. The subcommittee agreed to work on the report that evening and submit changes to Mr. Martin who would incorporate all changes and develop a master working draft for distribution to the members on Thursday morning.

Returning to the issue of demonstrating to OMB how PM/ozone research projects are contributing to improving health, Dr. Rodes asked for clarification of the meaning of outcome from the perspective of OMB. Dr. Costa said that the OMB concept or definition of outcome requires the improvement of public health in some measurable way, such as morbidity and mortality reductions. Comparative measures give a good impression. Comparisons of ORD data to public health indicators or integration of findings with health databases would be good. Reduction of uncertainty and concrete accomplishments that are quantitatively measurable are best. Longitudinal measures, showing changes or progress from year to year, also work well. Dr. Ping explained that researchers now see such outcomes as implicit rather than explicit and measures are needed to improve the situation. Dr. Costa said that annual or biannual program evaluations also would offer the opportunity for PM programs to show changes over time.

Dr. Seigneur added that such reviews could include future projections similar to those shown in each of the days' presentations. Dr. Costa agreed and added that the current long-term goals, although designed to show improvement annually, were not acceptable to OMB. Rather, OMB wants to see the removal of all uncertainty. Dr. Demerjian suggested that cause and effect scenarios might be workable, and Dr. Lipsett suggested that something similar to customer satisfaction surveys would generate outcome information. Dr. Costa agreed that such measures would show that the primary clients were being reached. Dr. Vickery advised taking advantage of health studies that cross into PM issues and gave the example of a hepa filter study being conducted in schools. He also suggested the use of peer panels to evaluate the percent of uncertainty improvement and development of a numeric or qualitative uncertainty scale as possibilities for measuring health outcomes. Dr. Henderson thought that relating findings to a very long-term goal, similar to "developing a cure for cancer," would show outcomes and continued improvement as a journey of steps over time. Dr. Seigneur asked if the subcommittee could recommend qualifying uncertainty as high, medium, or low, to show progress over time. Dr. Costa responded that they could, and added that all of the aforementioned suggestions would be more credible coming the subcommittee as part of the evaluation report.

In closing the meeting for the day, Dr. Henderson thanked Drs. Costa and Vickery for clarifying points related to outcomes. Dr. Costa thanked the subcommittee members for their perseverance and for responding to the review and evaluation tasks within a very limited time frame.

The meeting was recessed at 5:40 p.m.

THURSDAY, MARCH 31, 2005

Review of Wednesday's Activities and Overview of Today's Agenda

Dr. Rogene Henderson, Subcommittee Chair

Dr. Henderson opened the meeting at 8:30 a.m. with a review of Wednesday's activities and the revised schedule for the day. She informed participants that because several members could not stay through Friday, the subcommittee had agreed to work Wednesday evening so the meeting could end today. She then introduced Dr. Andrew Miller.

Session 3: Pollutant Source to Health Outcome: Moving Toward a "One Atmosphere" Understanding of Air Pollution

Overview

Dr. Andrew Miller National Risk Management Research Laboratory (NRMRL), ORD, EPA

For his presentation on pollutant source-to-health outcome, Dr. Miller said that he would provide examples of research that epitomize the source-to-health outcomes approach and talk about foundations that current and future research will build upon. He said that controversies associated with the 1997

setting of the NAAQS form the basis of this research program. The program is trying to answer the questions NAAQS raised by addressing adverse effects such as mortality. The heart of the source-to-health outcomes program is the fully integrated source-to-health outcome approach. Many areas of research are important to understanding health outcomes. Each area is important to understanding how sources are related to health outcomes, and is a part of a continuum of linkages across disciplines.

Dr. Miller said that the difference in this approach is integration across disciplines. The source-to-health outcome approach recognizes that health outcomes are linked to sources by a continuum of interconnected biological, chemical, and physical behaviors requiring a greater degree of integration across disciplines, an improved understanding of the entire problem, and additional research tools. Using this approach, there are several ways to measure outcomes. Single source effects, such as those from the Utah Valley Study, can be shown most clearly where an airshed is dominated by a single source type. In Utah Valley, significant changes in steel mill emissions led to significant changes in ambient PM concentration and composition. Multi-pollutant, multi-city studies link ambient concentrations to health effects and specific source types, providing valuable insight on source-to-health outcome linkage. Associating health outcomes with different source types provides additional information about source-related toxicity. Merging source apportionment techniques with epidemiology can yield important information about source-to-health outcome linkages.

The St. Louis Bus Study and the Car-related Occupational PM and Air Toxics Exposure of Patrolmen (COPP) Study integrate exposure and effects to evaluate health responses over much shorter times than would be possible with conventional epidemiology studies.

Dr. Miller referred to the study by Dr. Madden as a mixture of engineering and health that helps scientists understand how particles are formed. Other studies of exposure to primary PM from coal showed a significantly greater response to ultrafine particles than to fine or coarse particles from the same type of coal.

In his poster, Gary Norris addresses ambient particles in controlled exposures. His work shows how one can control the exposure to vary the dose and use source apportionment techniques to gain information about sources. Again, this links sources and effects. One cannot rely, however, on a single discipline to produce these outcomes. The Criteria Air Pollutant (CAP) studies, for example, require collaboration across multiple areas of expertise such as source characterization, ambient monitoring, apportionment modeling, and toxicology to acquire the necessary data.

To tease out the effects of complex mixtures, Dr. Miller said it is necessary to control inputs by creating an atmosphere that simulates a real world atmosphere. Dr. Kleindintz's poster illustrates this approach. The California study of roadways as PM sources showed that particle characteristics change significantly as the distance from the freeway increases. Essentially, the change in distance functions the same as a controlled response, allowing a much finer spatial resolution of effects than is possible when using central monitoring data.

Dr. Miller referred participants to Dr. Helen Suh's poster for information on exposure and health at shorter time scales. The St. Louis Bus study and the COPP study integrated exposure measurements and health effects to evaluate health responses over much shorter times than would be possible with conventional epidemiology studies. Studies with shorter time scales enable the effects of peak exposures to be measured, and they show health responses over a shorter period than with 24-hour mass data. The shorter time scales method also allows identification and measurement of spikes. Time models are another part of mixing different research disciplines to show health effects. Dr. Kleeman's poster focuses on air quality models for health.

ORD sponsors "science with a purpose," and that purpose is to provide the most complete and up-to-date science possible for development and implementation of standards. Posters by Drs. Baldeuph and Cook

show how ORD and OAR work closely together to define research needs, communicate findings, and help interpret results to inform regulatory decision-making. Both entities agree that better science means more effective standards and regulations, increased benefits, and ultimately, better public health.

Mr. Bachmann and Dr. Stone present posters that look at accountability issues beyond simply measuring changes in air quality and health.

To address the question “Why Now?”, Dr. Miller explained that the science is still important and it is evolving into new areas addressing cardiovascular, neurological, and neonatal effects. More understanding is needed because there are many gaps related to how people are exposed to PM. Atmospheric chemistry will continue to change, and new sources are emerging. All must be understood to support future decision making after new rules are implemented. In addition, ORD still needs to measure the effectiveness of regulatory actions, which goes back to accountability.

The practical implications of a source-to-health outcomes approach are development of a stronger science foundation and strengthening of evidence of PM health effects. Source-to-health outcome is not one approach, and no one approach will suffice. The field still needs to understand the impact of epidemiology and CAPs studies and the use of different scales and different approaches to build on current experience. ORD’s purpose is to identify and reduce risks from PM pollution, so the full range of expertise is needed, including engineers, atmospheric scientists and modelers, exposure researchers, health scientists, and policy experts. The full range of support systems also is needed along a fully coordinated management structure.

ORD has provided an enormous return on the government’s investment in PM/Ozone research. Net benefits could exceed \$100 billion per year when a source-to-health outcomes approach to science is fully implemented. ORD science has made a clear difference in reducing the uncertainties associated with PM and its impact on health. Integrating across disciplines maximizes scientific effectiveness, provides more tools, and increases innovation producing a more efficient and effective program. ORD researchers are working to make a positive difference. ORD partnerships with OAR and others ensure that the work has real and beneficial outcomes beyond advancing the science.

Questions and Comments

Subcommittee Members and EPA Staff

Dr. Demerjian stated that it is difficult to determine which sources to characterize because several variables cannot be controlled. He asked whether EPA has measurement tools to accomplish this. Dr. Miller replied that no network is in place to make the changes in all components involved. The Detroit study looks at some of this, but it does not measure the national impact. With 24-hour data, variability is an issue. Dr. Costa added that EPA is at a transition point trying to address complex challenges and cannot take advantage of initiating different types of studies overnight.

Dr. Henderson asked whether real observations match EPA models. Dr. Miller said some details make it harder to match models. The research generates many inputs and therefore, increases uncertainty. By using several models, uncertainty can be quantified.

Dr. Ping asked how EPA plans to publicize study results that identify adverse health effects to assist prevention efforts. Dr. Miller replied that there is no specific plan, but EPA researchers report findings to medical societies and otherwise educate medical personnel. Dr. Devlin indicated that many studies provide information on protection from the effects of PM.

Poster Session 3

Poster Session 3 was held in the Atrium area of the building. For this session, 13 posters were reviewed. Before the meeting, Dr. Henderson assigned each subcommittee member 3 to 7 posters to review and evaluate thoroughly. 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.

Poster Session 3 Discussion

Subcommittee Members

The large number of posters to be reviewed for this session did not permit in depth discussion of each. For the open discussion following the poster session, the Chair asked subcommittee members to summarize in one or two sentences, the main points made in each poster reviewed. This method offered all subcommittee members the opportunity to obtain general impressions of the posters he or she had not reviewed personally. With the assistance of background and supporting materials, subcommittee members attending the meeting by telephone participated in all aspects of the poster session, including discussion of their assigned posters with the presenter(s) and the open discussion following the poster session. Drs. Henderson, Stewart, and Ping and Mr. Croes discussed the posters they had reviewed, commenting on the value of having the opportunity to discuss the research with some of the scientists who had performed the work and to obtain additional details. Other subcommittee members added comments about the high quality of all the poster sessions. Overall, the members found the posters to be informative, the research impressive, and the progress toward the goals to be positive. Evaluative commentary on posters will be incorporated into the subcommittee's report on the program review of the PM/Ozone Research Program.

General Discussion of All Sessions

Subcommittee Members

To begin the discussion, Dr. Rodes asked whether EPA could clarify the means by which a researcher selects one or more public or private sector research partners. Dr. Costa indicated that partnerships often are formed based on the common needs of all involved. Dr. Vickery said that most researchers put out a general call to the broader scientific community to ascertain interest in a particular topic.

Dr. Stewart asked about the status of resources, given the current flat funding and the drop in full-time equivalents (FTEs) devoted to research. How does one allocate inadequate resources to meet a study's needs? Dr. Costa noted that funding priorities change each year and that the reduction in FTEs is an issue across the entire Agency. He suggested that the post-doctoral program might be helpful as a means of increasing staff as well as increasing networking.

Dr. Rodes asked about the level of commitment made to long-term funding in strategic areas. Dr. Hal Zenick replied that ORD's first commitment is to the work deemed the highest priority, and that funding is continued until the work has been completed. Therefore, projects in process must be completed before a new project can be considered.

Returning to the issue of measuring outcomes in relation to health, Dr. Demerjian voiced concern about long-term goals. He suggested that researchers set up health outcome studies based on one or more hypotheses and speak to future implications of the work as a means of adjusting to the OMB outcome criteria. Dr. Costa commented that OMB seeks single item measures that can be examined over time, such as milestones or short- and long-term goals.

Working Lunch

Subcommittee Members

The subcommittee members assigned to the various sections of the report used the lunch break to revise their portions of the evaluation report.

Session 4: Perspectives on the Air Program

Science Perspective

Dr. Mark Utell Co-Director, PM Center, University of Rochester

Dr. Utell presented information on the science perspective of the PM Research Program review. He drew attention to the fact that one of the recommendations of the NRC was that Agency scientists make a major effort to integrate the multidisciplinary sciences into their own thinking about the science. He said the PM/Ozone Research Program is a flagship program that is highly integrated and recognized in terms of science quality and relevance. The only questions remaining focus on how major outcomes should be presented. Dr. Utell stated that yesterday Dr. Rodes commented on the amount and complexity of the science represented in poster sessions, and this morning, Dr. Ping raised a concern about transferring this body of research from the laboratory to the clinic. These comments touch on the hallmark of the PM/Ozone Research Program; in terms of the science going from the bench to the clinic, it is the most successful effort EPA has produced in such a short time. A review of the changes that have taken place over the past 5 years confirms this.

In 1999, the lung was considered the portal of entry and the target organ for PM. Susceptible populations were primarily those with underlying lung disease. Evidence linking PM with cardiac mortality and hospital admissions was emerging, but no mechanism existed to explain the devastating health effects of PM. The change over time and the major outcomes of the PM/Ozone Research Program can be seen in these two facts:

1. "In 1999, diseases of the heart accounted for over 700,000 deaths in the US or 30% of all deaths (NHLBI, 2000). At that time, neither cardiologists nor cardiovascular scientists linked cardiac morbidity and mortality with air pollution.
2. By 2004, based on PM research results that began to be reported in 2001 and 2002, the American Heart Association issued a statement on air pollution and cardiovascular disease pointing out the public health implications. This alerted cardiologists to the need to address something that had not been high on their list of considerations 5 years before."

Dr. Utell emphasized that in 5 years, the field of environmental cardiology had emerged. He said that things usually happen much more slowly in medicine with regard to indoctrinating another discipline into consideration. Because cardiology is the largest discipline in internal medicine, it is clear that the PM program has had a profound effect. Dr. Utell added that the brief history of association between PM and cardiac problems should be reviewed.

Evidence of increased cardiac mortality began to emerge in the 1990s. At that time, interesting epidemiological observations included increased cardiac mortality, increased hospitalizations for cardiovascular diseases, and increased hospitalizations for congestive heart failure. In addition, toxicological observations showed heart rate variability affects in the elderly and changes in the expression of adhesion molecules on leukocytes in healthy subjects.

The phenomenon of a major output of PM research is the battery of health outcomes related to PM that were not recognized in 1999. Now, there are plenty of exposure data, not only on adults, but also on

children, and on healthy persons and ill persons. Several posters address the subject. Discussion about actual PM human exposures versus outdoor measures have increased. There have been advances in personal monitoring, i.e., data collection is now feasible in healthy adults, children, and those with chronic diseases. The only drawback is that insufficient data have been generated to relate measurements to national or global perspectives. A body of new information related to PM dosimetry has been developed as well. There is increased evidence of PM_{2.5} deposition in obstructive lung disease, high deposition of ultrafine particles, and new recognition of the potential translocation of PM directly to the bloodstream and the brain.

Important PM challenges for the future include the commitment to a long-term study of cardiovascular disease, expansion of preliminary observations on the degenerative disease health effects of PM, and further development of toxicology studies that have been initiated. The emergence of the “one atmosphere,” concept, or the combining and understanding of PM and ozone components that cause adverse health effects, will link both to sources and mechanisms. The science is moving so quickly that the field of susceptibility factors constitutes a new science.

OAR Perspective

John Bachmann, OAQPS, OAR, EPA

Mr. Bachmann opened his presentation by stating that much of what he had to present had been covered during the course of the meeting, and, therefore, he would keep his comments short. He said that EPA’s air regulatory programs are a major consumer and contributor to the PM/Ozone Research Program. OAR’s view is that we are in a one-atmosphere state of being, although some areas within PM and ozone force consideration of multi-pollutant approaches. Mr. Bachmann stated that the air quality management process must do many things beyond studying air pollution. The program handles multiple interactions between science and policy, such as establishing national/regional rules for multi-pollutants, establishing national rules for mobile sources, and imposing regional controls for major stationary sources. He noted that need to improve in the areas of planning and verifying the effectiveness of monitoring.

Currently, OAR is rethinking air quality management to face the multiple challenges of the future, including protecting health and welfare in the absence of threshold exposure, ensuring environmental justice, assessing and protecting ecosystem health, adapting air quality management to climate changes that now are known and understood better than ever, and responding to calls for improved accountability.

Mr. Bachmann acknowledged that science is the driver with respect to monitoring and air quality protection. Scientists need to address inventories and data analysis as well as reverse and forward modeling. Eventually, scientists must decide what needs to be controlled to make the air cleaner, and which method is the most effective in terms of cost and health protection. Regulatory functions also come into the equation.

In reviewing this meeting’s topics, Mr. Bachmann noted that there were three areas being addressed: health and exposure research, air quality research, and source-to-health outcome research. Health and exposure research touches on health indicators, averaging time, levels, and forms related to the NAAQS. Air quality research looks at emissions, air quality monitoring, analyses, modeling, and source assessment. Source-to-health outcome research provides new indicators of exposure and information on health outcomes. Data from this research help OAR decide whom to regulate and how to evaluate results. Mr. Bachmann stated that OAR introduced Supersites, and ORD has kept them going. There is a great deal of cooperation between OAR and ORD with regard to issues arising from Supersite research. Several OAR posters highlight other key science/policy links. These posters show ORD’s contribution via national and regional rules for mobile and stationary sources.

In looking at areas that are not meeting the NAAQS, Mr. Bachmann commented that it is clear that PM and ozone are OAR’s highest priority. In terms of monitoring strategy, FRMs are supplemented by

speciation and co-pollutant monitoring. STAR grant sites are monitored speciation sites in nonurban areas. OAR uses data from these sources to develop policy and control strategy and to coordinate with the health research community. OAR also uses these data and the AQI to determine how to address the composition problem. Increasingly, serving the community needs rather than just setting policy has become important; although policy is OAR's number one product, advancement of science is always a factor. From a source perspective, looking at the PM/ozone composition in a major city, it is clear that PM is composed of many different particles, several of which are considered toxic air pollution. Understanding the composition of PM helps OAR to assess levels of control and improve measurement technologies.

OAR is changing the chemical climate of North America through national rules for mobile sources effecting motor vehicle standards and regional controls for major stationary sources of PM and ozone. The Clean Air Interstate Rule (CAIR) and other programs greatly reduce transported ozone and particle pollution. OAR's future research and attention efforts should go toward evaluating areas that still have problems with residual nonattainment of ozone and fine particles. That is the key job of air quality management.

As far as evaluating results, last year OAR saw the biggest improvement in ozone emission reduction in the monitors located in and around the largest centers. OAR wants to continue this trend and see very significant reductions in the next decade in this part of the world.

The NRC recommendations to improve the U.S. air quality management system are to strengthen scientific and technical capacity, expand national and multi-state control strategies, transform the SIP process, develop an integrated program for criteria and hazardous and toxic air pollutants, and enhance protection of ecosystems and public welfare.

There are emerging challenges for air policy; the evolving PM/Ozone NAAQS always present challenges because they are changing constantly. The issue of reducing risks from toxic air pollutants and protecting health and welfare in the absence of threshold exposures are being addressed by research and the overall mandate to show source-to-health outcomes.

Public Comments

Mr. Martin informed participants that no one had contacted him to request time to speak during this period allotted for public comments and questions.

Science/Program Wrap-Up

Dr. Daniel Costa, National Program Director for Air, ORD, EPA

Dr. Costa reviewed the issues raised and addressed during the meeting and those that have to be addressed through evaluation of the PM/Ozone Research Program. He presented his information in terms of what the meeting had accomplished, what had been learned, and what still had to be done, using "we" in the global sense. He said one of the things ORD tried to do was gain some perspective on outcomes. In many ways, we found that our work on outcomes needs to be expanded. In terms of relevance, we did a reasonably good job of showing that the science that informs the regulatory process is relevant. In terms of the quality and impacts of the work, Dr. Costa stated that the science is good but needs further development. It is critical that the work is integrated across disciplines, and we need to improve some of the interdisciplinary aspects of the work. The integrated approach theme has been very beneficial to the program. Contributions come from many: intramural staff, cooperators (e.g., the STAR program), publishers, and contractors. Each one plays a role in accomplishing EPA's goals and objectives.

Dr. Costa said that we defined some of our progress by addressing outcomes and talked extensively about how we measure progress in the future. Restructuring of long-term goals and refinements are still needed, especially with regard to source-to-health outcome measures and accountability approaches. EPA cannot afford to do things the way we have always done them. Continuing to do so, will sustain our existence but it will not prepare us to meet the many challenges ahead. ORD is the toolbox for implementing integrated and interdisciplinary approaches. Partnering is an important part of the future. Much has been done with respect to partnering, and we need to continue to forge more partnerships and work with other agencies and scientists that have something to offer. Dr. Costa noted that partnering complements what we do best.

Addressing internal issues, Dr. Costa talked about the need to overcome some organizational issues and relax some of the structures. We also need to develop a new mindset. This means facing and changing the ways in which we do some things by improving program flexibility and responsiveness. Our priorities need to reflect the needs of our clients as well as the science needs, and we need to keep our mission focused.

ORD is in transition. Outcomes that make sense must be defined and we should move forward in our efforts to attain them. We need to address OMB demands for outcome measures and determine project outcomes that can be accomplished. Better communication of the results of our work is vitally important as well. Initially, we were not sure what OMB wanted with respect to outcomes, but now we know what must be done to relate our findings to them.

Looking ahead, Dr. Costa said that scientists must prepare to conduct air pollution science for the next generation. Evolution brings sustainability to the program and spawns the development of innovative, integrated science. We need to look at “one atmosphere” and find ways to dissect it and identify its factors. A multi-pronged approach to source-to-health outcomes is key. Science integration, linking sources to outcomes, accountability, and multilevel approaches to our work are necessary. We also need interim steps to show the progress of the science and the intellectual correctness of our choices, including mid-stream corrections. We need to draw the big picture and, within it, develop a structure to show accomplishments, through a variety of means.

Dr. Costa closed by comparing the challenge of the job to be done to a quote from President John F. Kennedy. He said, “We will step up to the challenges ahead of us, not because they are easy but because they are hard.”

Work Session

Subcommittee Members

Subcommittee members used approximately 30 minutes to pose questions to ORD staff, comment on the evaluation report sections completed by other subcommittee members, collaborate with their partners on the language and structure of their assigned sections of the report, reach consensus on areas of disagreement, and exchange information to assist overall preparation of the subcommittee’s report. Thereafter, each member worked on his or her assigned section of the report without further discussion. When they had completed the work on their respective sections, the members shared information relating to the places in which their topics overlapped to assure consistency in presentation of their preliminary findings.

Debriefing and Oral Reports on Charge Questions

Subcommittee Members

In debriefing the EPA staff, Dr. Henderson asked the subcommittee members to present their preliminary responses to the charge questions.

Program Design and Demonstrated Leadership

Drs. Demerjian and Lamb

Drs. Demerjian and Lamb reported that their overall response to the questions on program design and demonstrated leadership was positive. The goals set for accomplishments are easy to quantify. LTG 1 is fine as is. LTG 2 needs some rewording. It seems to be the product of two or three hypotheses addressing epidemiology and health, but it does not cover all aspects of PM.

Science Quality

Drs. Henderson and Ping

Dr. Ping spoke for herself and Dr. Henderson on the topic of science quality, noting that there were three questions within the charge.

Question 1: “Is the science being conducted by EPA/ORD research Labs and Centers of recognized high quality and appropriate to the perceived needs?”

Response: Yes. Intramural and extramural programs are of high quality. There are many journal citations of this work and the principal investigators have solid credentials.

Question 2: “Is program integration across Labs, Centers, and science disciplines making full advantage of research opportunities?”

Response: Yes. Successful integration of programs has taken place.

Question 3: “Does the program ensure high quality research through competitive, merit-based funding? If funds are not competitively awarded, what process does the program use to allocate funds? Does this process ensure that quality is maintained?”

Response: This area needs some work. It was noted that NRC priorities are used to assess program priorities for funding.

Relevance

Drs. Rodes and Lipsett

Drs. Rodes and Lipsett related their impressions on the topic of relevance as follows:

Question 1: “Does the PM-Ozone MYP structure and Research Program clearly reflect its focus and the rationale behind its research direction and out-year emphasis?”

Response: The PM-Ozone MYP is relevant and the level of integration is impressive. There are concerns about the lack of directed funding for ozone research.

Question 2: “Are the potential public benefits in terms of public health protection and pollution abatement clearly articulated?”

Response: The health cost/benefits are clearly articulated.

Question 3: Has the PM-Ozone Research Program effectively engaged stakeholders in its assessment processes, and provided useful information and tools in a timely manner?

Response: Yes, there are clear and extensive linkages at all levels in the program.

Question 4: “Has the Program begun to establish a process for using the results of assessments, along with stakeholder feedback, to identify key research gaps and to update the Program’s research agenda?”

Response: Yes, the program has gone beyond beginning to do this with well-established partnerships with public and private entities. There are some concerns about the status of anticipatory research and work on coarse particles.

Demonstrated Outcomes

Dr. Seigneur and Mr. Croes

Dr. Seigneur and Mr. Croes said that the program shows flexible approaches to air pollution and has ambitious targets and timeframes. There is sufficient scope and quality to the programs and types of outcomes addressed. Many positives were noted. The amount of work being done at EPA is more extensive than originally thought. More information is needed before LTGs can be evaluated.

Dr. Costa thanked the subcommittee members for their outstanding effort in reviewing the program. He also said that he would share some of the information he had collected for his report with the subcommittee.

Dr. Henderson closed the meeting by stating that the subcommittee's overall impression of the work being done by EPA in the area of PM-ozone research is very positive.

The meeting was adjourned at 5:15 p.m.

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BOARD OF SCIENTIFIC COUNSELORS Particulate Matter/Ozone Program Subcommittee Meeting March 30–31, 2005

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APPENDIX:
Meeting Agenda

**U.S. EPA BOARD OF SCIENTIFIC COUNSELORS
Particulate Matter and Ozone Program Subcommittee**

**DRAFT MEETING AGENDA
March 30, 2005 – April 1, 2005**

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

Wednesday, March 30, 2005 (Room C-111 B/C)

8:00-8:30 a.m.	Registration	
8:30-8:45 a.m.	Welcome and Opening Remarks Subcommittee Chair	Dr. Rogene Henderson
8:45-8:50 a.m.	DFO Welcome and Charge - Administrative Procedures and FACA Rules - Objective of This Subcommittee and Charge	Lawrence Martin (EPA) DFO
8:50-9:00 a.m.	ORD's Welcome Acting DAA–Science, ORD	Dr. William Farland (EPA)
9:00-9:30 a.m.	Overview of ORD's Air Program	Dr. Daniel Costa (EPA) ORD Nat'l Prog. Dir. for Air
9:30-9:45 a.m.	Discussion of General Program Issues	Dr. Daniel Costa (EPA) ORD Nat'l Prog. Dir. for Air
9:45-10:00 a.m.	Break	

Session 1: NAAQS Health and Exposure Research

10:00-10:30 a.m.	Overview: Health and Exposure	Dr. Robert Devlin (EPA) ORD/NHEERL
10:30 a.m.-12:00 p.m.	Poster Session (Atrium)	Subcommittee
12:00-12:30 p.m.	Discussion	Subcommittee
12:30-1:30 p.m.	Working Lunch	Subcommittee

Session 2: Air Quality Management Presentation

1:30-2:00 p.m.	Overview	James Vickery (EPA) ORD/NERL
2:00-3:30 p.m.	Poster Session (Atrium)	Subcommittee
3:30-3:45 p.m.	Break	
3:45-4:15 p.m.	Discussion	Subcommittee
4:15-5:30 p.m.	Working Session	Subcommittee
5:30 p.m.	Adjourn	

Thursday, March 31, 2005 (Room C-111 B/C)

8:30-8:40 a.m.	Review of Wednesday's Activities Overview of Today's Agenda	Dr. Rogene Henderson Subcommittee Chair
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Session 3: Pollutant Source to Health Outcome: Moving Toward a "One Atmosphere" Understanding of Air Pollution

8:40-9:10 a.m.	Overview	Dr. Andy Miller (EPA) ORD/NRMRL
9:10-10:45 a.m.	Poster Session (Atrium)	Subcommittee
10:45-11:00 a.m.	Break	
11:00-11:30 a.m.	Discussion	Subcommittee
11:30-11:45 a.m.	General Discussion Across Sessions	Subcommittee
11:45 a.m.-12:45 p.m.	Working Lunch	Subcommittee

Session 4: Perspectives on the Air Program

12:45-1:10 p.m.	Science Perspective	Dr. Mark Utell Co-Dir. PM Ctr. / Univ. Roch.
1:10-1:30 p.m.	OAR Perspective	John Bachmann (EPA) OAQPS/OAR
1:30-1:50 p.m.	Public Perspectives	
1:50-2:00 p.m.	Science/Program Wrap-up	Dr. Daniel Costa (EPA) ORD Nat'l Prog. Dir. for Air
2:00-5:00 p.m.	Break/Work Session	Subcommittee
5:00-5:30 p.m.	Debrief	Subcommittee

Oral Report on Charge Questions

5:30 p.m. Adjourn

Friday, April 1, 2005 (Room C-111 B/C)

8:00-8:10 a.m. Review of Thursday's Activities Dr. Rogene Henderson
Subcommittee Chair

8:10 a.m.-12:00 p.m. Work Session

**PARTICULATE MATTER
RESEARCH PROGRAM REVIEW
List of Themes and Poster Titles**

SESSION 1: HEALTH AND EXPOSURE RESEARCH	
What Are the Adverse Health Effects Associated With Exposure to PM and How Are These Effects Caused?	
What Is the Relationship Between Personal Exposure and Ambient Fixed Site Measurements?	Ron Williams (NERL)
What Are the Uncertainties Associated With the Epidemiological Estimates of PM Health Risks and the Methods Employed in Developing Those Estimates?	Joel Schwartz (Harvard University)
What Are the Physiological Mechanisms by Which PM Causes Adverse Cardiac Effects?	William P. Watkinson (NHEERL)
Does Inhalation of Air Pollution Particles Affect Vascular Function?	Mark W. Frampton MD (University of Rochester)
What Are the Physiological Mechanisms by Which PM Causes Adverse Respiratory Effects?	Steve Gavett (NHEERL)
What Are the Cellular and Molecular Mechanisms by Which PM Causes Adverse Health Effects?	James M. Samet (NHEERL)
What Are the Long-Term Health Effects of PM?	Morton Lippmann (New York University)
What Are the Long-Term Health Effects of PM?	Barbara Glen (NCER) Joel Kaufman (University of Washington)
ORD Science Contributes to the Development of National Ambient Air Quality Standards for PM.	Mary Ross (OAQPS)
ORD Research Affects Public Health Action and Community Outreach.	Susan Stone (OAQPS)
Who Is Susceptible?	
What Do Exposure and Dosimetry Studies Tell Us About the Dose to the Susceptible Populations?	Chong Kim (NHEERL)
How Does PM Impact Subpopulations with Cardiovascular Disease (Elderly)?	Wayne Cascio (East Carolina University)
Does Particulate Matter Cause or Exacerbate Asthma?	David B. Peden, University of North Carolina Center for Environmental Medicine, Asthma & Lung Biology

How Does Underlying Cardiopulmonary Disease Influence Response to PM in Animals?	Urmila P. Kodavanti (NHEERL)
How are Emerging PM Susceptible Populations Being Identified and Characterized?	Kevin Dreher (NHEERL)
How Do Gene/Environment Interactions Modulate PM-Induced Adverse Health Effects?	Yuh-Chin Tony Huang (NHEERL)
What Physical/Chemical Attributes of PM Are Responsible for Adverse Health Effects?	
What Are the Effects of Ultrafine Particles?	Günter Oberdörster (University of Rochester)
What Are the Bioactive Components in Coarse Particulate Matter?	Ian Gilmour (NHEERL)
What Are the Effects of Metals?	Andrew Ghio (NHEERL)
Chemical Mechanisms of Particulate Matter Toxicity	John R. Froines, A.K. Cho, A. Nel, C. Sioutas (Southern California Particle Center and Supersite)
How Can Statistical Approaches (e.g., PCA) Be Used to Link PM Components With Health Effects?	John Godleski (Harvard University)

SESSION 2: AIR QUALITY MANAGEMENT	
What Are the Sources of PM (and Co-pollutants)?	
How Have Recent Advances in Emission Estimation Methods and Models Improved Inventories of Primary PM and Precursor Gases That Form Secondary PM and Ozone?	David Mobley (NERL), Sue Kimbrough (NRMRL), Bill Kuykendal (OAQPS)
How Can We More Accurately Measure Emission Fluxes of Precursor Gases Emitted from Area Sources That Form Secondary PM?	Bruce Harris (NRMRL), John Walker (NRMRL)
What Are the Contributions to Ambient PM and Ozone From Biogenic and Other Natural Emission Sources?	Chris Geron (NRMRL), Tom Pierce (NERL)
What Are the Contributions to Ambient PM and Ozone Concentrations From On-road Diesel and Gasoline Vehicles?	Rich Baldauf (NERL), John Kinsey (NRMRL)
How Well Can We Control Emissions of Multiple PM Precursors From Coal-Fired Power Plants?	Andy Miller (NRMRL)
How Can Emissions Inventories Be Improved for Source Apportionment and Health Associations?	Ted Russell (Georgia Tech), Alice Gilliland (NERL)
What is the Atmospheric Characterization of PM (and Co-pollutants)?	
How Can We Measure Ambient Concentrations of Fine and Coarse PM Mass for Regulatory Purposes?	Bob Vanderpool (NERL)
How Can We Measure Ambient Concentrations of Speciated Fine and Coarse PM Mass to Support Improvements in the Ambient Air Quality Standards?	Paul Solomon, Tim Watkins (NERL)
ORD Science Supports Air Quality Modeling	Rich Scheffe (OAQPS)
How Can We Measure Rapid Fluctuations in Carbonaceous Aerosol Composition?	Jose Jimenez (University of Colorado at Boulder)
What Are the Processes That Govern PM (and Co-pollutants)?	

What Are the Precursors to and Formation Processes for Secondary Organic Aerosols?	Ed Edney (NERL)
How are Results From ORD's Community Multi-scale Air Quality Model (CMAQ) Used to Forecast Air Quality?	Ken Schere (NERL)
How Well Does CMAQ Predict Ambient Concentration of PM Components, PM, and Ozone?	Alice Gilliland, Robin Dennis, Brian Eder, Prakash Bhawe (NERL)
Air Quality Models Are Used To Predict Reductions in Air Pollution	Joe Paisie (OAQPS)
What Characteristics of Source Emissions Can Be Used to Identify the Contribution of Different Source Types to Ambient PM Concentrations?	Mike Hays (NRMRL)
How Is CMAQ Used To Support State and Tribe Implementation Plans for Regional Haze?	Gail Tonnesen (University of California at Riverside)
How Can Receptor Models Be Applied To Estimate the Contribution of Different Source Types to Ambient PM Concentrations?	Shelly Eberly (NERL)

SESSION 3: SOURCE TO HEALTH OUTCOME	
Do Exposures to Mobile Source Particles Damage Health?	Helen H. Suh (Harvard PM Center)
Physical and Chemical Characteristics of PM Near Freeways Impacted by Heavy- and Light-Duty Traffic	Constantinos Sioutas, John R. Froines (Southern California Particle Center and Supersite)
Health Effects Associated With Particulate Matter Near Southern California Freeways	John R. Froines (Southern California Particle Center and Supersite)
What Are the Effects From Controlled Exposures to Specific Sources?	Michael Madden (NHEERL)
Pulmonary Toxicity of Utah Valley PM: Are Empirical Indices of Adverse Health Effects Coherent With the Epidemiology?	Janice A. Dye (NHEERL)
Source Apportionment and Multi-City/Multi-Pollutant Studies	Lucas Neas (NHEERL)
Can Laboratory Chambers Be Used To Create a Complex Atmosphere for Use in Animal Exposure Studies?	Tad Kleindienst (NERL)
How Can Organic Tracers and Source Apportionment Modeling Be Used in Health Studies?	James Schauer (University of Wisconsin)
How Can Concentrated Ambient Particles Used in Health Studies Be Tied to Specific Source Types?	Gary Norris (NERL)
How Can Air Quality Models Provide Detailed Source Attribution and Component Distributions for Health Studies?	Mike Kleeman (University of California at Davis)
How Are Ambient Monitoring, Personal Exposure, and Health Related?	Allen Vette (NERL)
ORD Research Supports Mobile Source Regulatory Decisionmaking	Rich Baldauf (OTAQ/NERL)
Accountability: Measuring Improvements in Public Health From Reduced Air Pollution	Susan Stone, John Bachmann (OAQPS)