United States
Environmental
Protection Agency

EPA Science Advisory
Board (1400F)
Washington, DC

EPA-SAB-CASAC-05-006
May 2005
www.epa.gov/sab

EPA's Final Draft National Ambient Air Monitoring Strategy

An Advisory by the Ambient Air Monitoring and Methods Subcommittee of the EPA Clean Air Scientific Advisory Committee

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

April 20, 2005

EPA-SAB-CASAC-05-006

OFFICE OF THE ADMINISTRATOR
SCIENCE ADVISORY BOARD

Honorable Stephen L. Johnson
Acting Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Subject: Clean Air Scientific Advisory Committee (CASAC) Advisory on Implementation Aspects of the Agency's Final Draft National Ambient Air Monitoring Strategy (NAAMS) (December 2004)

Dear Acting Administrator Johnson:

The Clean Air Scientific Advisory Committee's (CASAC) Ambient Air Monitoring and Methods (AAMM) Subcommittee ("Subcommittee") met on December 15, 2004 to conduct an advisory meeting on implementation aspects of the Agency's Final Draft National Ambient Air Monitoring Strategy (NAAMS or "Strategy"). The public meeting was held at the staff offices of the EPA Science Advisory Board (SAB) in Washington, DC. Members of the Subcommittee are recognized, national-level experts in one or more of the following disciplines or areas: (1) atmospheric sciences and air quality simulation modeling; (2) human health effects and exposure assessment; (3) air quality measurement science; (4) ecological risk assessment; and (5) State, local agency or Tribal experience. The Subcommittee roster is found in Appendix A of this report.

In general, the CASAC finds that the Agency's ambient air quality monitoring program is beginning to implement the changes necessary to bring it in line with the NAAMS strategy document. There are and will be a number of scientific issues that will arise as the progress is made in reconfiguring the network and as new knowledge with respect to monitoring, modeling, and effects becomes available. CASAC AAMM Subcommittee members' individual review comments are provided in Appendix B.

1. Background

The CASAC, which comprises seven members appointed by the EPA Administrator, was established under section 109(d)(2) of the Clean Air Act (42 U.S.C. 7409) as an independent scientific advisory committee, in part to provide advice, information and recommendations on the scientific and technical aspects of issues related to air quality criteria and national ambient air

quality standards (NAAQS) under sections 108 and 109 of the Act. The CASAC, which is administratively located under the SAB Staff Office, is a Federal advisory committee chartered under the Federal Advisory Committee Act (FACA), as amended, 5 U.S.C., App. The SAB Staff Office established the CASAC AAMM Subcommittee in July 2004 as a standing subcommittee to provide the EPA Administrator, through the CASAC, with advice and recommendations, as necessary, on topical areas related to ambient air monitoring, methods and networks. The Subcommittee complies with the provisions of FACA and all appropriate SAB Staff Office procedural policies.

In late 2002, EPA's Office of Air Quality Planning and Standards (OAQPS), located within the Office of Air and Radiation (OAR), issued a draft National Ambient Air Monitoring Strategy. OAQPS subsequently requested that the CASAC review the draft NAAMS document and provide advice and recommendations to the Agency on the technical bases and design aspects of the Strategy. The SAB Staff Office announced the formation of the NAAMS Subcommittee of the CASAC on November 5, 2002 (67 FR 67403). The CASAC NAAMS Subcommittee held a public meeting in Research Triangle Park, North Carolina, on July 8-9, 2003 (68 FR 34945, June 11, 2003) to conduct this review of the draft Strategy document. The primary recommendations of the CASAC NAAMS Subcommittee, through the chartered CASAC, included a request for an implementation plan, and added emphasis on rural- and ecosystem-oriented monitoring, support for the National Core Monitoring Network (NCore) Level 1 program, and training and quality assurance to enhance data consistency across the Nation. The CASAC NAAMS Subcommittee's complete report from this review is found on the SAB Web page at URL: http://www.epa.gov/sab/pdf/casacl04001.pdf. OAQPS updated the NAAMS document after the CASAC's review of the Strategy. The revision incorporated EPA's responses to the CASAC NAAMS Subcommittee's recommendations.

Last spring, the SAB Staff Office announced (69 FR 19180, April 12, 2004) the formation of the CASAC AAMM Subcommittee. This subcommittee replaced the former CASAC NAAMS Subcommittee. Subsequently, OAQPS asked the CASAC AAMM Subcommittee to conduct an advisory meeting for the purpose of providing advice and recommendations on the implementation plan for its updated final draft NAAMS, which is posted on EPA's Ambient Monitoring Technology Information Center (AMTIC) Web site at the following URL: http://www.epa.gov/ttn/amtic/files/ambient/monitorstrat/allstrat.pdf.

2. CASAC AAMM Subcommittee Advisory on Implementation Aspects of the Agency's Final Draft NAAMS

The purpose of this meeting was to review the progress toward implementation of the Final Draft NAAMS. The OAQPS requested that the Subcommittee provide expert advice and recommendations on the following charge questions, which focus on key implementation issues:

1. The CASAC has expressed its support for the Agency's proposal to redesign the routine PM monitoring network to support PM precursor gas measurements (CO, SO_2, NO/NOx, NH_3, HNO_3) at NCore Level II multiple-pollutant sites, and for air quality management decisions and to obtain relevant exposure data for research programs. Given limited budgetary resources, does this represent both an appropriate and adequate balance, as reflected by the relative resource allocations provided in Section 11, "Draft

Implementation Plan," of the Final Draft NAAMS Document? In addition, are the relative adjustments in the training and guidance approaches proposed in the draft implementation plan consistent with the overall objectives of the Strategy?

2. The implementation plan proposes a series of communication actions to advance the NCore Level 2 network, in order to more directly support long-term health effects research and provide better support to ecosystem assessments through an increased level of coordination. Does the CASAC AAMM Subcommittee have additional suggestions for addressing this need for integration and communication to the broader community of "users," including scientific researchers (*i.e.*, human health, atmospheric, ecological) and State, local and Tribal (SLT) Agency representatives? More specifically, what is the most effective manner for EPA both to reach-out to this broad user community and, where appropriate, to incorporate their feedback and design input on such issues as monitoring site locations and parameters?

3. One of the remaining technical issues relates to harmonizing rural- and urban-based $PM_{2.5}$ chemical speciation networks such that both categories of networks utilize consistent sampling and analysis protocols. For example, EPA is considering converting all of the Speciation Trends Network (STN) speciation sites to Interagency Monitoring of Protected Visual Environments (IMPROVE) samplers and IMPROVE laboratory and sample handling protocols. What are strengths and weaknesses of this approach?

4. As EPA implements the National Ambient Air Monitoring Strategy to address multiple monitoring objectives, it will be looking to spatially *optimize* the ambient monitoring networks. This may mean that some redundant monitors in adjacent, but separate, geopolitical areas (*e.g.*, neighboring counties) are "divested" from a given network. Although technically sound, these divestments could result in data gaps which might, in turn, adversely impact regulatory decision-making. The Agency is willing to adopt alternative approaches for assessing regulatory issues such as non-attainment designations, so long as such approaches are scientifically justifiable; hence, the rationale for initiating discussion of these issues with the CASAC. Is it scientifically acceptable to generate isopleths of airborne species concentrations through *modeled* observations and/or *integrated predictive/observational* fields that would be of appropriate uncertainty for use in the regulatory decision-making process?

Before the discussion of the implementation plan and related issues, the Subcommittee would like to commend the OAQPS staff for the responsive manner in which they have revised the original draft monitoring strategy in response to the comments provided by the CASAC NAAMS Subcommittee (EPA-SAB-CASAC-LTR-04-001) [the URL for this report is found in the Background section above]. Several members of the present Subcommittee were also members of this earlier group, and there was strong approval by these individuals to the changes that have been made in the Final Draft NAAMS Document.

The Subcommittee discussed these issues sequentially and this report will provide the subcommittee recommendations. Individual comments from the subcommittee members on each of these issues are provided in Appendix B to this report.

Question 1

The first issue is that of resource allocation as the redeployment of monitoring resources starts to be implemented. The Subcommittee continues to support the need for Level 1 (L1) sites as a means for testing of new monitoring technology and moving it to routine use. Substantial advances in monitoring technology have been obtained through the EPA Particulate Matter (PM) Supersites. That exercise provided the opportunity to test and refine new instrument concepts. It is recognized that such an effort cannot be sustained at the level of the Supersites, but some level of continuing support is critical to continue the improvements in data that are needed to provide the underpinning of future regulatory decisions. Since one of the main purposes of L1 sites would be to help transition new methods into routine use, it may be useful to develop the L1 sites as cooperative efforts between a research team and state or local regulatory agency personnel.

There was some discussion as to potential sources of funding that could be diverted to the establishment of L1 sites. There were suggestions from several members that Photochemical Assessment Monitoring Stations (PAMS) monitoring could potentially be reduced beyond the recommendations of the implementation plan. It may be that there is not a need for as many standard monitors and that more advanced instrumentation integrated with a few L1 sites or limited duration special studies might be more effective in providing the information needed for making the needed air quality management decisions. However, in those locations where it is felt useful to maintain existing data collection, consideration should be given to extending this operation through the entire year. Although it is unlikely that there will be ozone violations in the winter, the data on organic constituents can be useful for understanding exposures to and sources of toxic hydrocarbons and $PM_{2.5}$ precursors, for tracking effects of changes in gasoline or diesel fuel content, and for evaluating emissions inventories and air quality models.

An important consideration is the allocation of resources for data analysis as an integral part of the network. End uses of the data are too often afterthoughts, and planning for an initial set of data analyses is an essential part of the design process. There are too many examples of inadequate planning and resources to use the data collected by routine network operations and it would be useful to better match the data uses with the effort to acquire the data as an integral part of the overall plan. Although all of the possible uses for data cannot be anticipated, many of the typical analyses can be anticipated and included in the implementation plans together with the requisite budget. CASAC strongly recommends that the Agency give greater consideration to identification of the amounts of financial and human resources that will be allocated for data analyses and interpretation activities. In this connection we call special attention to the written comments on "outreach and extension of findings" and "analysis and interpretation of monitoring results" by CASAC members in Appendix 2.

There were suggestions that there needed to be more effort placed on time-resolved measurements. Long-term integrated measurements lose critical information. It is generally better to get more detailed time-resolved information for shorter time intervals than to have long time interval integrated measurements. With careful design and appropriate statistical methods, these episodic measurements can still lead to adequate descriptions of annual averages and trends. There is so much additional benefit to the time-resolved measurements that the effort needs to be made to move strongly in that direction. As indicated in the report from the earlier

Subcommittee on Fine Particle Monitoring, it is important to retain an appropriate number of integrated filter samplers to provide a basis for comparisons with the past monitoring record and appropriate quality assurance checks on the monitoring program.

Although the commercially-available instruments commonly used for measuring NO_x concentrations are appropriate for ensuring compliance with the health-based national ambient air quality standard for nitrogen oxides, they are not sensitive enough to be useful for making decisions about NO_x vs. VOC sensitivity of ozone non-attainment areas. Such information is also important for understanding particulate matter formation. Most commercial instruments have a minimum detection limit for NO of about 1 ppb, but decisions about NO_x vs. VOC sensitivity require instruments that have minimum detection limits of about 0.1 ppb. Similarly there is a need for improvements in other gas phase species methods to provide the sensitivity required for all of the other objectives other than compliance testing. There is also a need for more measurements of key gas-phase species like NH_3 and HNO_3. At this time it appears there needs to be additional development efforts to provide semi-continuous measurements of these species and their particle-phase counterparts.

Finally, there needs to be greater consideration of general HC characterizations in NCore. The treatment of carbonaceous compounds is currently a weak part of the monitoring strategy. As a first step, continuous total NMOC measurements should be included in the NCore L2 sites or at least a subset thereof.

With the promulgation of the Clean Air Mercury Rule on March 15, 2005 that will require controls on mercury emissions from coal-fired power plants, it is important that monitoring be put in place to measure the atmospheric concentrations of mercury species. Such an effort should be put in place as quickly as possible so as to gather baseline data before controls can actually be put in place and maintained for a sufficiently long period as to ascertain the changes in atmospheric concentrations that occur as a result of these controls. Given that there is likely to be regional caps, as part of a cap and trade program, appropriate regional strategies will be needed to provide the necessary accountability data.

Question 2

There is consensus within the committee that the single most effective way for EPA to reach out to potential users of its data is to make these data easily accessible via the internet. The committee was encouraged by the staff presentation on current plans for Web access, and expressed a desire to move rapidly toward getting this portal into operation with the flexibility to adjust it as experience with its use is obtained. There is concern that there may be bottlenecks between network operation and data availability. We support pushing the access to raw data behind EPA's "AIRNow" Web site as quickly as possible and would like to encourage their Steering Committee to move things ahead.

Another issue that needs to be addressed is computer-to-computer access. For users who continuously update graphical displays or model calculations, access for an automatic download of data is an important aspect of the accessibility of the data. Providing protocols for such access should be part of the plans for the data access Web site.

It would be helpful to combine ancillary data from other agencies such as the visibility data from airports into the data base. It may be useful for EPA to discuss the development of combined data sets with the variety of other Federal agencies that have air-quality data sets such as NASA, NOAA, and DOE.

In terms of communications, it may be useful to consider organizing regional workshops to get broader input into network modifications and data use. In particular, this may be the appropriate way to bring the ecological community into the discussions. The move to site more monitoring in rural areas needs the active participation of the ecological community to balance the needs of the air quality modelers with those interested in understanding the ecological effects of air pollution. Since ecosystems vary widely from region to region across the country, regional workshops or similar forums can provide a means for meaningful participation by those interested in ecological systems.

It is not clear that additional efforts are needed to get the health community involved other than making the data readily-accessible. It is likely that a number of health researchers would make use of data if they are easily accessible. However, changes to the network affect the ability of epidemiologists to use the data and there needs to be effective communication with this community to permit EPA to understand the potential impacts of any changes that are planned for the network. The network is being redeployed to serve multiple objectives and regulatory needs will take priority, but good communications can permit maximal exchange of points of view and an opportunity to make better decisions on the redeployment of monitors.

Question 3

There is strong general support for making substantial changes to the 54 STN Trends sites to ensure compatibility with IMPROVE data. Currently, it is not possible to fully combine STN and IMPROVE data in spatial studies or in model evaluations since there are significant differences in sampling and analysis. However, it needs to be fully understood what is meant by IMPROVE-protocol sites. At present, the IMPROVE program controls all aspects of the system from sampling to analysis. STN utilizes state and local agencies to operate the samplers.

The IMPROVE sampler uses a critical orifice rather than active flow control, and thus, provides a less stable particle-size cutpoint. IMPROVE uses 25 mm filters and higher flow rates that have the advantage of having higher areal density of material on the filters as compared with the STN samplers. However, there has been concern regarding the possibility of clogging of the Teflo filters that could lead to invalid samples during extreme events and/or to changes in the cut-point for the cyclone inlets. IMPROVE-protocol sampling has been conducted in Washington, DC; Seattle, WA; and Phoenix, AZ for a number of years without clogging being a substantial problem. The IMPROVE experience has been that clogging has only been observed in major fire episodes so it may not be a problem or could be accommodated by changing the sampling protocol to a half-hour within each hourly time interval or by terminating the sample at less than 24 hours if flow rates drop significantly. These data would be flagged appropriately to indicate that they do not represent the full time interval.

There are existing problems of harmonization of data from IMPROVE and STN that need to be addressed. It has recently been recognized that there are significant differences in the XRF results from the two networks and quite different approaches to the reporting of errors for the XRF results. There are now on-going discussions between RTI, ChesterNet Lab and the University of California at Davis regarding the XRF analyses and reporting of the XRF errors, and it is anticipated that these differences may be resolved. There may need to be some additional samples run by all of the laboratories in round robin studies to resolve discrepancies in the values and reported errors, and OAQPS should support these efforts.

There are substantial differences in the organic and elemental carbon fraction (OC/EC) methods. These differences have been reported in the literature. However, there is no "right" answer since the measured species are defined by the analytical method. IMPROVE uses a dynamic blank to correct the OC data while STN uses only field and laboratory blanks. Blank sampling and reporting is thus an area requiring harmonization. Another key issue is the type of filter. Because of potential differences in the type of quartz filters used by the STN and IMPROVE programs, it is recommended that the STN use the same filter type as used by IMPROVE (*i.e.*, Pall Tissuequartz) to ensure consistency. There are a number of other issues such as differences in the storage, the analysis of cations, shipping conditions, etc. that need to be harmonized. It should be noted that IMPROVE will soon be changing their method because of the need to replace the existing analytical instruments. A commercial instrument is now available to implement the IMPROVE time-temperature protocol. Studies to date suggest that the OC and EC values by both the old and new instruments are comparable, but the values of the thermal fractions can have significant variations. There will then be changes in the data being reported in the IMPROVE network. Therefore, it is an appropriate time to change the STN network to what will shortly be the new IMPROVE protocol so that there will be comparability between the measurements.

Thus, the key question is whether or not to change the Trends sites to the IMPROVE protocol at this time. If these 54 STN sites are fully converted to IMPROVE, it will guarantee the comparability of the data and thus, permit the comprehensive use of the compositional data obtained in the future. For other sites in the network, it would be useful to provide this alternative to the SLT organizations that are control these sites. At this time, it is unclear if there is sufficient capacity at the University of California at Davis to handle these additional sites. If the filter preparation and analyses are done by the existing STN contractor, there will still be a problem of data harmonization that needs to be addressed to ensure comparability of results from the different laboratories. The Subcommittee recommends that to achieve fully comparable data, it will require that all of the samples be collected in an identical manner with identical samplers. The samples would then be analyzed by a single laboratory for any given chemical constituent with a single approach to error estimation, data validation, etc.

The decision to change the monitoring approach for the STN and/or the IMPROVE network must also take into account emissions sampling protocols and methods. If the two databases are incompatible, this will inhibit accurately identifying source impacts. Similar studies that compare ambient measurements (*i.e.*, between the IMPROVE and STN methods) need to be done for emissions measurements. If one technique (e.g., the NIOSH vis B vis IMPROVE for EC/OC) proves better for conducting emissions measurements (*i.e.*, provides a

more stable measurement), this should affect the choice for use in ambient monitoring (and vice versa). Whichever techniques are ultimately used, all parties should recognize and account for these tangential impacts and issues. Thus, there also needs to be the development of source sampling methods that utilize the same sampling and analytical methods as the ambient network so that the resulting source characterizations can be used in the interpretation of the ambient aerosol composition data.

Question 4

The generation of surfaces of air quality parameters needs to be generated by a combination of measurements and model simulations. Both measurements and model results have uncertainties associated with them. Measurements are made at specific locations and represent a limited geographical area. Alternatively, models average results over the minimum size of the grid cell and cannot fully reproduce the local environment.

Thus, the use of integrated predictive/observational fields is the preferred approach. While there is much work to be done here, this approach will help tackle multiple issues. First, it is probably the best way to extend an observation (or sets of observations) both spatially and temporally, if necessary. Second, it can be used in the process of source apportionment (or vice-versa: source apportionment can be used in extending the use of observations). Third, it will help identify uncertainties in the representativeness of the observations at a monitoring location. Fourth and finally, it will produce the type of information that can be used by groups identified in Question 2.

Therefore, conceptually the combination approach is the appropriate way to proceed. However, we still do not have the best approach laid out, and the enabling technologies developed (*e.g.*, software/hardware environments to provide this information). These issues can probably be tackled within three or four years. Such a process should utilize the observations available, both *in situ* and remote (for example, satellite) as well as PM modeling (with data assimilation). There should be a feedback loop where the information provided by the integrated system utilizes additional approaches to assess the quality of the fields developed (e.g., data withholding, etc.). While this may seem ambitious, EPA should set as a goal, to have a field of source apportioned daily/monthly/yearly PM for the U.S. by 2010 (*e.g.*, target $PM_{2.5}$ and coarse PM for 2008, with the apportioned fields developed by 2010). The work should also include fields of the uncertainties in the integrated daily PM levels and, at least, in the annual source apportionments. These results should be updated on an ongoing, annual basis. If the resources were currently available, it is likely that this integrated approach could be achieved by 2008 (using 2006 data).

Thus, we find that the Agency's ambient air quality monitoring program is beginning to implement the changes necessary to bring it in line with the NAAMS strategy document. There are and will continue to be a number of scientific issues that arise both as progress is made in reconfiguring the network and as new knowledge with respect to monitoring, modeling, and effects becomes available. Thus, there is the need for a continuing process for the ongoing review and assessment of the monitoring program. The CASAC has found it to be very valuable to review and offer its advice and recommendations to the Agency in the development of the current monitoring strategy, and further advises that periodic reevaluation be built into the

monitoring network plans to ensure that the network continues to meet the multitude of needs that are expected to change over time. Therefore, we recommend that the CASAC Ambient Air Monitoring and Methods Subcommittee continue to serve in this role. As always, the CASAC wishes the Agency well in this very important endeavor.

Sincerely,

/Signed/

Dr. Rogene Henderson, Chair
Clean Air Scientific Advisory Committee

Appendix A – Roster of the CASAC AAMM Subcommittee

Appendix B – Review Comments from Individual CASAC AAMM Subcommittee Members

cc: Steve Page (MD-10)
Rich Scheffe (MD-14)
Phil Lorang (MD-14)
Tim Hanley (MD-14)
Jake Summers (MD-12)
Anthony Maciorowski (1400F)
Fred Butterfield (1400F)

Appendix A – Roster of the CASAC AAMM Subcommittee

U.S. Environmental Protection Agency
Science Advisory Board (SAB) Staff Office
Clean Air Scientific Advisory Committee
CASAC Ambient Air Monitoring and Methods (AAMM) Subcommittee*

CHAIR

Dr. Philip Hopke, Bayard D. Clarkson Distinguished Professor, Department of Chemical Engineering, Clarkson University, Potsdam, NY
Also Member: SAB Board

CASAC MEMBERS

Dr. Ellis Cowling, University Distinguished Professor At-Large, North Carolina State University, Colleges of Natural Resources and Agriculture and Life Sciences, North Carolina State University, Raleigh, NC

Mr. Richard L. Poirot, Environmental Analyst, Air Pollution Control Division, Department of Environmental Conservation, Vermont Agency of Natural Resources, Waterbury, VT

SUBCOMMITTEE MEMBERS

Mr. George Allen, Senior Scientist, Northeast States for Coordinated Air Use Management (NESCAUM), Boston, MA

Dr. Judith Chow, Research Professor, Desert Research Institute, Air Resources Laboratory, University of Nevada, Reno, NV

Mr. Bart Croes, Chief, Research Division, California Air Resources Board, Sacramento, CA

Dr. Kenneth Demerjian, Professor and Director, Atmospheric Sciences Research Center, State University of New York, Albany, NY

Dr. Delbert Eatough, Professor of Chemistry, Chemistry and Biochemistry Department, Brigham Young University, Provo, UT

Mr. Eric Edgerton, President, Atmospheric Research & Analysis, Inc., Cary, NC

Mr. Henry (Dirk) Felton, Research Scientist, Division of Air Resources, Bureau of Air Quality Surveillance, New York State Department of Environmental Conservation, Albany, NY

Dr. Rudolf Husar, Professor, Mechanical Engineering, Engineering and Applied Science, Washington University, St. Louis, MO

Dr. Kazuhiko Ito, Assistant Professor, Environmental Medicine, School of Medicine, New York University, Tuxedo, NY

Dr. Donna Kenski, Data Analyst, Lake Michigan Air Directors Consortium, Des Plaines, IL

Dr. Thomas Lumley, Associate Professor, Biostatistics, School of Public Health and Community Medicine, University of Washington, Seattle, WA

Dr. Peter McMurry, Professor and Head, Department of Mechanical Engineering, Institute of Technology, University of Minnesota, Minneapolis, MN

Dr. Kimberly Prather, Professor, Department of Chemistry and Biochemistry, University of California, San Diego, La Jolla, CA

Dr. Armistead (Ted) Russell, Georgia Power Distinguished Professor of Environmental Engineering, Environmental Engineering Group, School of Civil and Environmental Engineering, Georgia Institute of Technology, Atlanta, GA

Dr. Jay Turner, Associate Professor, Chemical Engineering Department, School of Engineering, Washington University, St. Louis, MO

Dr. Warren H. White, Visiting Professor, Crocker Nuclear Laboratory, University of California - Davis, Davis, CA

Dr. Yousheng Zeng, Air Quality Services Director, Providence Engineering & Environmental Group LLC, Baton Rouge, LA

SCIENCE ADVISORY BOARD STAFF

Mr. Fred Butterfield, CASAC Designated Federal Officer, 1200 Pennsylvania Avenue, N.W., Washington, DC, 20460, Phone: 202-343-9994, Fax: 202-233-0643 (butterfield.fred@epa.gov) (Physical/Courier/FedEx Address: Fred A. Butterfield, III, EPA Science Advisory Board Staff Office (Mail Code 1400F), Woodies Building, 1025 F Street, N.W., Room 3604, Washington, DC 20004, Telephone: 202-343-9994)

* Members of this CASAC Subcommittee consist of:

a. CASAC Members: Experts appointed to the statutory Clean Air Scientific Advisory Committee by the EPA Administrator; and

b. CASAC Subcommittee Members: Experts appointed by the SAB Staff Director to serve on one of the CASAC's standing subcommittees.

Appendix B – Review Comments from Individual CASAC AAMM Subcommittee Members

This appendix contains the preliminary and/or final written review comments of the individual members of the Clean Air Scientific Advisory Committee (CASAC) Ambient Air Monitoring and Methods (AAMM) Subcommittee who submitted such comments electronically. These comments are included here to provide both a full perspective and a range of individual views expressed by the Subcommittee members before, during and after the Subcommittee's December 15, 2004 advisory meeting on implementation aspects of the Agency's Final Draft National Ambient Air Monitoring Strategy (NAAMS). These comments do not represent the consensus views of the CASAC AAMM Subcommittee, the CASAC, the EPA Science Advisory Board, or the Environmental Protection Agency (EPA) itself. The list of Subcommittee members providing individual comments is provided on the next page, and their review comments follow.

Panelist **Page #**

Dr. Ellis Cowling …….B-3

Mr. Richard L. Poirot …….. B-11

Mr. George Allen …… B-17

Dr. Judith Chow …….. B-20

Mr. Bart Croes …….B-29

Dr. Kenneth L. Demerjian ……...B-33

Dr. Delbert Eatough ……..……B-36

Mr. Eric Edgerton ……..……..B-41

Mr. Henry (Dirk) Felton ……..B-44

Dr. Rudolf Husar …… B-48

Dr. Kazuhiko Ito ……..B-53

Dr. Donna Kenski ……B-56

Dr. Thomas Lumley …….B-58

Dr. Peter McMurry …….. B-61

Dr. Armistead (Ted) Russell…….B-65

Dr. Jay Turner ……..B-70

Dr. Warren H. White ……... B-73

Dr. Yousheng Zeng ……..B-75

Dr. Ellis Cowling

Comments by Ellis Cowling on
Implementation Aspects of EPA's National Air Monitoring Strategy (NAAMS)

After careful reading of all 12 sections of the Final Draft NAAMS and many of the 164 public comments and EPA responses in the Addendum to the Final Draft, I offer the following comments especially with regard to the first question in the Charge to the CASAC Ambient Air Monitoring Subcommittee.

General Comment 1)
With regard to the Agency's proposal to redesign the routine precursor gas measurements (CO, SO_2, NO/NO_y NH_3, HNO_3) at NCore Level II multiple pollutant sites and for air quality management decisions and to obtain relevant exposure data for research programs, permit me to mention that scientists in the Southern Oxidants Study drew the following general conclusion from our major field measurement campaigns in Atlanta and Nashville in 1990, 1992, 1994, and 1999:

> "In comparison with research-grade instruments, the commercially-available instruments commonly used for measuring NO_x concentrations in air: are not sensitive enough to measure NO reliably, and are not specific enough to measure NO_2 reliably."

Although the commercially-available instruments commonly used for measuring NO_x concentrations are appropriate for ensuring compliance with the health-based national ambient air quality standard for nitrogen oxides, they are not sensitive enough to be useful for making decisions about NO_x vs. VOC sensitivity of ozone non-attainment areas. Most commercial instruments have a minimum detection limit for NO of about 1 ppb, but decisions about NO_x vs. VOC sensitivity require instruments that have minimum detection limits of about 0.1 ppb.

Perhaps I missed it, but I was unable to find in the Final Draft Strategy document an adequate discussion of the minimum detection limits for nitrogen oxides and the other precursor gases listed above.

General Comment 2)
The preamble to Charge Question 1 asks:
"Given limited budgetary resources … is the information on resource allocations provided in Section 11 with regard to support for PM precursor gas measurements at NCore Level II multiple pollutant sites appropriate and well balanced and consistent with the overall objectives of the Strategy."

My response to this question is: "Yes, in part, with respect to the proposed gas measurements at NCore Level II multiple pollutant sites."

The specific wording of Charge Question 1 goes on to ask: "Are the relative adjustments in the training and guidance approaches in the plan consistent with the overall objectives of the Strategy?"

My response to this specific question is "Yes, by in large." But if the question is rephrased -- as I believe it should be -- to read: "Are the relative adjustments in the training, guidance, analysis, interpretation, and communication approaches consistent with the overall objectives of the Strategy?" my response would be a resounding "No!"

Sections 1, 2, 9, 11, and 12 of the Strategy all give strong emphasis to analysis, interpretation, and communication of results from the various monitoring networks described in the NAAM Strategy.

This is especially true of the statements in Section 1.2 on 'Goals and Objectives,' Section 1.3 on 'Scope of Participants and Key Operating Principles' (most notably) its subsection on 'Data Analysis and Interpretation,' and Section 1.4 on 'Recommendations" (especially the statement "A strong public communications program is advocated, both at national and local levels."

This is also true of the statements in Section 2.2 on 'Network Assessment,' and Section 2.6 on 'Communication and Outreach.'

It is especially true of many statements in the early parts of Section 9 on 'Communications and Outreach,' (most notably) in Section 9.1.1 on 'Benefits to State and Local Agencies, Public Interest Groups and the General Public,' Section 9.1.2 on 'Benefits to the research and Academic Community,' and Section 9.1.3 'Benefits to Tribal Communities.'

But the description in Section 9.2 about 'How This Information Will be Communicated' seems to be both 'inconsistent and not appropriately balanced' with the statements in Sections 9.1.1, 9.1.2, and 9.1.3. The 'Fact Sheet,' 'Quarterly Newsletter,' 'Specialized Briefing Presentations' using 'packaged slide presentations,' and the 'Monitoring Strategy Brochure' all appear to be focused on descriptions of the 'monitoring program' rather than to 'policy-relevant scientific findings' from the monitoring measurements.'

Various parts of Section 11, especially Section 11.3 on 'Resource and Funding Strategy,' and Section 11.3.1 on 'Implementation Using Current Funding Basis,' Tables 11-1 and 11-2 and especially Table 11-3 on 'Proposed summary of redistributed Federal resources,' and even more notably Table 11-6 on 'Implementation Schedule' give little or no information on 'Data Analysis,' and even less information on 'interpretation,' 'communication,' and 'outreach.'

In Section 12 on 'Issues' the distinction between 'Classical' and 'Value' perspectives is discussed. Please note especially the last part of the section on 'Value:'
"The real success of the Strategy ultimately will require … cultural modification upgrades [within both EPA and state, local and tribal communities] that allow for a [more] meaningful dialogue across data generators and data user communities." In this respect the statements in Section 12.4 on 'Addressing Data Availability and Data Analysis Needs,' and in Section 12.4.2 on 'Data Archiving, Distribution and Analysis Efforts' are relevant.

So far as I can find in the Strategy document, there is only one monitoring program in which a specific discussion about needs for data analysis and interpretation is discussed directly with specific dollars allocated for data analysis and interpretation. This is the PAMS program. Please note the first paragraph on page 11-5. It reads in part as follows (see also Table 11-3 on page 11-9):

c. PAMS. PAMS requirements have been scaled down to allow for more specific special studies of interest by local area/regions. The current $14 M Federal 105 STAG contribution to PAMS should be reduced to $12M, an amount sufficient to cover the revised, minimum PAMS monitoring requirements. There has been a wealth of data collected from the PAMS program, but very limited and often sporadic analysis and interpretation of the data. To address this gap and yield value from the PAMS data bases, $0.5M will be set aside for analysis of the PAMS data.
[This amounts to an allocation of only about 4% of the current annual cost of the PAMS program and does not consider cumulative funding for PAMS during years in which analysis and interpretation was 'very limited and often sporadic.']

My recommendation is that our CASAC AAMM Sub-Committee offers the following recommendations regarding Implementation Aspects of the NAAM Strategy:

1) Financial and human-resource allocations for analysis, interpretation, and communication of monitoring results should be increased substantially for each of the several monitoring programs described in the National Ambient Air Monitoring Strategy including the programs for SLAMS, NAMS, PAMS, PM2.5, Toxics, CASNET, IMPROVE, and the NCore network.
2) A summary table should be developed for inclusion in a revised Section 11 that shows the approximate relative allocations within each monitoring program -- for the monitoring measurements themselves, and separately for analysis, interpretation, and communication of scientific findings from each of the monitoring networks described in the NAAM Strategy.
3) CASAC should initiate an endeavor together with OAQPS, selected universities, and various state, local, regional and tribal organizations of air quality managers. The objective would be to: a) Identify individuals and organizations that have been unusually successful in analysis, interpretation, and communication of scientific findings from monitoring networks; and b) Use these lists to foster and encourage more frequent analysis, interpretation, and communication of results from the several monitoring networks described in the Final Draft National Ambient Air Monitoring Strategy. In this connection, please see the attached documents on the Environmental Statistics Program at NC State University

Further Background Information for General Comment 2:

On July 22, 2004, CASAC held a "Consultation on Methods for Measuring Coarse-Fraction Particulate Matter (PMc) in Ambient Air, Based upon Performance Evaluation Studies Conducted by EPA." At that time I made two points that may be worth repeating in connection with the current CASAC discussions on "Implementation Aspects of the Final Draft of the National Ambient Air Quality Monitoring Strategy."

Point 1) EPA and many other federal research and monitoring organizations need to guard against the tendency to allocate so much of the funds used in monitoring programs and field measurement campaigns to "making careful measurements" so that inadequate funds are

available for "scientific analysis and interpretation" to determine and communicate to users what the measurements really mean.

These cautionary remarks about problems in field monitoring programs were suggested originally by the late Glenn Cass, formerly of Cal Tech and later of Georgia Tech, on the basis of his career-long experience in various environmental monitoring programs -- programs in which too much funding was allocated to "measurements" and too little to "analysis and interpretation" of the data and "communication of results" from the field measurements. In this connection, please note the attached excerpts from a paper published in Water, Air and Soil Pollution in 1995.

Please also note especially the suggestion in the second item 9 about a "50:50 distribution" of funding allocations between "measurements" and "analysis and interpretation" of monitoring data rather than the (90:10 or 80:20 distribution) that is typical of many monitoring programs in EPA and other agencies. But please also note that an even better suggestion was made by Mary Barber, former executive leader with the Ecological Society of America who spoke in opposition to the "50:50 distribution" idea at a recent Whitehouse Conference on monitoring. Mary Barber insisted, and I agree with her, that it would be even more appropriate to distribute the funding into three rather than two categories of investments -- with equal shares going to "measurements," "analysis and interpretation," and "outreach and extension of findings" to interested clientele and "customers" for the results of routine field monitoring programs.

This problem is so commonplace -- not only in EPA but in many other agencies in this country and around the world -- that I commend these "lessons that are available to be learned" (and perhaps even the "15 reasons why this happens" and the "13 things to do about it") for inclusion among the comments from individual participants in the CASAC meeting on "Implementation Aspects of the Final Draft National Ambient Air Monitoring Strategy."

Point 2) EPA should also guard against the tendency to give undue emphasis to "Data Quality Objectives" in the selection and evaluation of instruments and subsequent implementation of field monitoring programs to the exclusion of concern about "Science Quality Objectives" and "Policy Relevancy Objectives."

Experience within the Southern Oxidants Study and other large-scale field measurement and monitoring campaigns have demonstrated repeatedly that undue emphasis on "Data Quality Objectives" often leads to:

1) Serious lack of attention to the scientific hypotheses and assumptions that are inherent in any choice of scientific instruments, the appropriateness of the ground-based sites at which the instruments are located, the skills of the instrument operators, the data processing and data-display programs used, and especially the scientific quality of the conclusions and statements of findings that are drawn from analysis and interpretation of the measurements that are made; and
2) Equally serious lack of attention to the policy relevancy of the measurements being made -- relevancy to the general or specific enhancements of environmental protection that are the real reason behind the public health or public welfare concerns that led to the decision to establish a monitoring program in the first place.

In this latter connection, permit me also to call attention to the attached "*Guidelines for the Formulation of Scientific Findings to be Used for Policy Purposes.*" These guidelines were developed originally by the NAPAP Oversight Review Board led by Milton Russell, former Assistant Administrator for EPA. Please find attached below, an electronic version of these Guidelines which we have adopted and very slightly adapted for use in formulating policy relevant scientific findings in the Southern Oxidants Study.

The original version of these Guidelines was published as Appendix III of the April 1999 Report titled "*The Experience and Legacy of NAPAP*." This was a Report to the Joint Chairs Council of the Interagency Task Force on Acidic Deposition of the Oversight Review Board (ORB) of the National Acid Precipitation Assessment Program. As indicated in Appendix III:

> "The following guidelines in the form of checklist questions were developed by the ORB to assist scientists in formulating presentations of research results to be used in policy decision processes. These guidelines may have broader utility in other programs at the interface of science and public policy and are presented here with that potential use in mind."

Excerpts from:

Cowling, E., and J. Nilsson. Acidification Research: Lessons from History and Visions of Environmental Futures. Water, Air and Soil Pollution 85:279-292. 1995.

LESSONS LEARNED ABOUT THE SOCIAL DYNAMICS OF MONITORING PROGRAMS AND FIELD RESEARCH CAMPAIGNS

We also observed that there is a social tendency among research scientists, to spend more time and energy developing new monitoring networks than in analysis and interpretation of already existing data, especially long time-series measurements. Glen Cass of the California Institute of Technology was one of the first to call this tendency to our attention. But we also have discussed this matter with other scientists and research leaders in Sweden, Norway, Germany, The Netherlands, Canada, and the United States. As a result we have come to believe that there are three general reasons and at least 15 specific reasons why this happens and four general things and at least 13 specific things that can be done about it.

Three General and Specific Reasons Why this happens

Personal/psychological reasons:

1) Some scientists think it is not appropriate to analyze data collected by other people.
2) Some scientists underestimate the time and creative energy it takes to do thorough analysis and interpretations of field data.
3) Some scientists prefer to concentrate on field measurements rather than the sometimes more demanding intellectual work of data analysis and interpretation.
4) Some instrumentalists and data analysts exaggerate small deficiencies in measurement methods so that they too readily agree to "get out and do it right" rather than "milk the data for all it is worth" before going to the field once again.
5) The tendency to believe that "there is nothing more tragic than a beautiful hypothesis slain by an ugly fact in your own data".
6) The tendency to "move on to other things" rather than recognize that "it is a sign of maturity if you finish things and a sign of immaturity if you just start new ones".
7) Some scientists think analysis and interpretation of long term trends is boring.

Social/psychological reasons:

8) The contagious enthusiasm that field campaigns seem to engender in groups of scientists, and which occurs less frequently in the usually more private intellectual work of data analysis and interpretation.

9) The tendency of some scientists to believe that those who collect the data "own" the data and thus can choose (regardless of what organization paid the bills for the program!) when, where, and under what circumstances of authorship, priority, etc., the data should be validated, archived, analyzed, interpreted, and made available to others.

10) The tendency of research leaders to avoid conflicts about the policy implications of research findings. For example, atmospheric monitoring data usually are not threatening, but data analyses sometimes lead to situations that have policy consequences that make for uncomfortable disputes. Since non-controversial portions of research programs proceed to completion more readily than parts of research programs facing opposition, it is not surprising that the atmosphere is over-measured and under-interpreted.

Budgetary/logistical reasons:

11) The tendency for unreasonable budget optimism. Exaggerated promises often are made to make a project appealing to sponsors -- promises that often cannot be fulfilled with the limited funds that usually are available. Since atmospheric or other field measurements occur at the beginning of a research program, they often are completed at the expense of resources needed later for thorough analysis and interpretation of data.

12) The tendency to buy what is cheap (or what is easy to do) rather than what is really needed (or may be difficult to do). Atmospheric measurements are individually rather cheap. (For example, the elemental composition of a single sample of fine particulate matter can be determined for about $120.) But the same measurement made within the stack of a particular pollution source may cost many thousands of dollars because of logistical difficulties and challenging environmental conditions (e.g., high temperatures).

13) Field measurement campaigns often are planned too soon after each other.

14) Granting agencies often assume that if they fund scientists to make field measurements that these same scientists will find the time and energy for analysis and interpretation whether they are funded to do so or not.

15) The too dominating role of tradition (what did we do last year?) as the "best guide" to wisdom in budget and personnel decisions.

Four General and Thirteen Specific Things That Can Be Done About It

Social/political things:

1) Recognize that monitoring programs cannot be sustained unless there are "customers" who care about the data, use the data often, and are willing to speak-out publicly about the constructive values they derive from analysis and interpretation of the data.

Personal/psychological things:

2) Recognize that people want to enjoy the work they do. Making atmospheric measurements in the field is both rewarding and fun. By contrast, collecting and tabulating real-world data regarding amounts of emissions can be tedious or even boring. Not surprisingly, few people want to do the necessary but boring part, and those who are pushed against their will usually do a sloppy job. Solution: Find ways to make data analysis more fun and rewarding! For example, give high praise and other rewards to those who willing to do what is necessary whether it is boring or not!

Scientific/intellectual things:

3) Formulate specific science and policy questions that are to be addressed and design measurement systems to answer those specific questions.

4) Use available guidelines for formulation of statements of scientific findings to be used for policy purposes -- See Appendix III in the Oversight Board Report (NAPAP 1991).

5) Place heavy emphasis on publication of results not only in peer-reviewed scientific journals, but also in readily accessible professional, environmental, commercial, and public-interest publications and electronically accessible information outlets.

Budgetary/logistical things:

6) Recognize how many significant scientific discoveries about the phenomena and effects of air pollution have been made by analyzing "old" data.

7) Find and fund those scientists who really enjoy data analysis and interpretation.

8) Buy the research that is really needed, not what is cheap or convenient.

9) Recognize that data archiving, analysis, and interpretation are tedious, time consuming, intellectually demanding, and expensive. An appropriate ratio for investment in measurements and investments in analysis and interpretation generally is closer to 50:50 than the customary ratio of only 10:1 or even 20:1. Also, it is valuable to use 2- to 5-year "roll-forward" mechanisms to ensure continuity of funding.

10) Recognize large measurement campaigns rarely can be sustained in successive years.

11) Plan research project and programs from the end backward to the start. First, specify the best data analysis procedures necessary to answer important science and policy questions within the available funds and time. Then, make or complete only those measurements that have a pre-specified place in the data-analysis plan.

12) Try to balance uncertainties in the time, cost, and performance of research projects so as to keep all three factors approximately on-target.

13) Initiate and maintain measurement programs to determine the effectiveness of environmental management decisions.

GUIDELINES FOR THE FORMULATION OF SCIENTIFIC FINDINGS TO BE USED FOR POLICY PURPOSES

The following guidelines in the form of checklist questions were developed by the NAPAP Oversight Review Board to assist scientists in formulating presentations of research results to be used in policy decision processes.

1) **IS THE STATEMENT SOUND?** Have the central issues been clearly identified? Does each statement contain the distilled essence of present scientific and technical understanding of the phenomenon or process to which it applies? Is the statement consistent with all relevant evidence-evidence developed either through NAPAP [or SOS] research or through analysis of research conducted outside of NAPAP [or SOS]? Is the statement contradicted by any important evidence developed through research inside or outside of NAPAP [or SOS]? Have apparent contradictions or interpretations of available evidence been considered in formulating the statement of principal findings?

2) **IS THE STATEMENT DIRECTIONAL AND, WHERE APPROPRIATE, QUANTITATIVE?** Does the statement correctly quantify both the direction and magnitude of trends and relationships in the phenomenon or process to which the statement is relevant? When possible, is a range of uncertainty given for each quantitative result? Have various sources of uncertainty been identified and quantified, for example, does the statement include or acknowledge errors in actual measurements, standard errors of estimate, possible biases in the availability of data, extrapolation of results beyond the mathematical, geographical, or temporal relevancy of available information, etc. In short, are there numbers in the statement? Are the numbers correct? Are the numbers relevant to the general meaning of the statement?

3) **IS THE DEGREE OF CERTAINTY OR UNCERTAINTY OF THE STATEMENT INDICATED CLEARLY?** Have appropriate statistical tests been applied to the data used in drawing the conclusion set forth in the statement? If the statement is based on a mathematical or novel conceptual model, has the model or concept been validated? Does the statement describe the model or concept on which it is based and the degree of validity of that model or concept?

4) **IS THE STATEMENT CORRECT WITHOUT QUALIFICATION?** Are there limitations of time, space, or other special circumstances in which the statement is true? If the statement is true only in some circumstances, are these limitations described adequately and briefly?

5) **IS THE STATEMENT CLEAR AND UNAMBIGUOUS?** Are the words and phrases used in the statement understandable by the decision makers of our society? Is the statement free of specialized jargon? Will too many people misunderstand its meaning?

6) **IS THE STATEMENT AS CONCISE AS IT CAN BE MADE WITHOUT RISK OF MISUNDERSTANDING?** Are there any excess words, phrases, or ideas in the statement which are not necessary to communicate the meaning of the statement? Are there so many caveats in the statement that the statement itself is trivial, confusing, or ambiguous?

7) **IS THE STATEMENT FREE OF SCIENTIFIC OR OTHER BIASES OR IMPLICATIONS OF SOCIETAL VALUE JUDGMENTS?** Is the statement free of influence by specific schools of scientific thought? Is the statement also free of words, phrases, or concepts that have political, economic, ideological, religious, moral, or other personal-, agency-, or organization-specific values, overtones, or implications? Does the choice of how the statement is expressed rather than its specific words suggest underlying biases or value judgments? Is the tone impartial and free of special pleading? If societal value judgments have been discussed, have these judgments been identified as such and described both clearly and objectively?

8) **HAVE SOCIETAL IMPLICATIONS BEEN DESCRIBED OBJECTIVELY?** Consideration of alternative courses of action and their consequences inherently involves judgments of their feasibility and the importance of effects. For this reason, it is important to ask if a reasonable range of alternative policies or courses of action have been evaluated? Have societal implications of alternative courses of action been stated in the following general form?:

"If this [particular option] were adopted then that [particular outcome] would be expected."

9) **HAVE THE PROFESSIONAL BIASES OF AUTHORS AND REVIEWERS BEEN DESCRIBED OPENLY?** Acknowledgment of potential sources of bias is important so that readers can judge for themselves the credibility of reports and assessments.

Mr. Rich Poirot

EPA NAAMS Implementation Proposal, Review Comments, R. Poirot, 12/12/04

Generally, this is a very strong, carefully considered, well justified and timely proposal. Many revisions are directly responsive to previous CASAC Subcommittee review comments. Emphasis on use of continuous methods – for multiple, collocated PM & gaseous precursor species, and de-emphasis on filter-based PM 2.5 and speciation is a resource-efficient means of supporting multiple monitoring objectives, including compliance determination, improved atmospheric model development & evaluation, and human health, ecological and welfare effects research.

1. **The CASAC has expressed its support for the Agency's proposal to redesign the routine PM monitoring network to support PM precursor gas measurements (CO, SO_2, NO/NOy, NH_3, HNO_3) at NCore Level II multiple-pollutant sites, and for air quality management decisions and to obtain relevant exposure data for research programs. Given limited budgetary resources, does this represent both an appropriate and adequate balance, as reflected by the relative resource allocations provided in Section 11, "Draft Implementation Plan" of the Final Draft NAAMS Document? In addition, are the relative adjustments in the training and guidance approaches proposed in the draft implementation plan consistent with the overall objectives of the Strategy?**

The question illustrates what seems to me to be a rather proscriptive emphasis on a specific suite of "precursor gasses" which is difficult to evaluate without additional detail on the specific siting criteria and on the other "required" or optional measurements at these sites. Regarding siting details, the general Level II formula (1/state, 2/state in moderately large states, 3/state in the largest population states, and 12 rural) sounds to me like it will be a very predominantly "urban" network, and that in addition there would likely be just 1 site per urban area in almost all cases. These many "1 per city" sites have limited value for supporting ecological effects research, for enhancing understanding of atmospheric chemical processes, for model development and evaluation, and for some of the proscribed gasses (like NO, CO & NH3) questionable value for characterizing regional spatial patterns. Urban site locations for highest human exposures of ozone, PM2.5 and some of the proscribed gasses differ by pollutants. So exactly what kind of "representative" sites are we looking for? On a related point, the inclusion of detailed met instruments is obviously desirable with all this continuous data, but what scale(s) of representation are we looking for in the met measurements, and will or should this further effect the siting criteria?

Regarding the other species measurements, I assume at minimum these include continuous ozone and PM2.5. Will there also be filter-based speciation measurements, and if so will the new measurements be added at existing STN sites, or will those "trends" sites be moved to the new optimized multi-pollutant sites? How exactly will continuous PM2.5 mass be measured? Ideally a single common method would be employed, rather than the current mix (all things being equal, I'd suggest the FDMS TEOM, as it provides higher resolution information (separate volatile and non-volatile), and may often capture volatile species partially lost from FRM filters).

Continuous (high sensitivity) SO2 is highly desirable, but the value of such data would be hugely enhanced if collocated continuous SO4 were also measured. NOy is useful (especially at rural sites), but could be substantially more useful if accompanied by continuous hydrocarbon analyzers. Aethalometers (especially the dual wavelength – with its potential value as a wood smoke monitor) could provide useful information with currently available, field-proven technology, and/or continuous OC/EC (Sunset Labs for example) look promising. Will any of these continues PM species measurements be included, or do we measure only the precursors?

The proposed monthly integrated NH3 and HNO3 measurements would substantially enhance the status quo (almost no data), but would obviously provide minimal temporal resolution (assuming the technologies work). A possible alternative or supplemental approach might be through routine extraction of denuders at STN and IMPROVE sites. See additional detail on this under question 3 below.

2. **Does the Subcommittee have additional suggestions for addressing this need for integration and communication to the broader community of "users," including scientific researchers (*i.e.*, human health, atmospheric, ecological) and State, local and Tribal (SLT) Agency representatives? More specifically, what is the most effective manner for EPA both to reach-out to this broad user community and, where appropriate, to incorporate their feedback and design input on such issues as monitoring site locations and parameters?**

Generally, the above "user communities" (human health, atmospheric, ecological, & SLTs) are very disparate groups who don't very often interact. Also, the most relevant health and ecological effects issues tend to vary on a regional basis, making "centralized" communication awkward. One organizational concept that might be worth considering is to organize periodic workshops on a regional basis, as there tend to be clustered integrated user communities who focus on specific urban health effects or rural ecological effects monitoring/research sites. Examples of the latter from my region include the Vermont Monitoring Cooperative at Mt. Mansfield/ Underhill, VT, Hubbard Brook, NH, Harvard Forest, MA & Whiteface Mtn, NY (unfortunately none of these is likely to become a Level II site, and I'm concerned my Underhill, VT "SIP" IMPROVE site may also be on the NCore chopping block). About 15 years ago, the International Air Quality Advisory Board of the IJC held a series of workshops on "Integrated Transboundary Monitoring" at 5 locations along the US/Canada border, which were very well-attended and productive. Possibly something like this might be considered on an EPA regional basis or through the Regional Planning Organizations (RPOs).

3. **One of the remaining technical issues relates to harmonizing rural- and urban-based $PM_{2.5}$ chemical speciation networks such that both categories of networks utilize consistent sampling and analysis protocols. For example, EPA is considering converting all of the Speciation Trends Network (STN) speciation sites to Interagency Monitoring of Protected Visual Environments (IMPROVE) samplers and IMPROVE laboratory and sample handling protocols. What are strengths and weaknesses of this approach?**

Spatial & urban/rural consistency alone are good reasons to consider this, with the added advantages that (I think) IMPROVE analytical, shipping & site operator costs are lower (though the new equipment costs would be significant and STN "trends" - for some species – would be disrupted).

What exactly is meant by IMPROVE methods? Samplers, filter media, "identical" copper anode XRF systems, TOR carbon methods – which are currently being revised in IMPROVE, etc? If IMPROVE PESA measurements for H are duplicated by STN, only a very few labs have that capability.

IMPROVE is cited in the EPA Strategy as serving as a "core rural speciation trends network: needed network adjustments are handled effectively through IMPROVE Steering Committee". While I generally agree here, it should be cautioned that being a core rural speciation trends network is serendipitous, but not an objective of IMPROVE, which is intentionally focused on regional haze-related aspects of aerosols in specific class I areas, and in recent years specifically focused on supporting the EPA Regional Haze Rule – which emphasizes long-term trends. Consequently there is added inertia to change, or for adding supplemental measurements to address non-haze-relevant issues.

Also, given the general tendency for class 1 areas to be located in mountainous terrain, the IMPROVE monitoring objectives to measure regional rather than local aerosols, and to cover each class I area (with funding constraints limiting sites to 1 per area), the IMPROVE network tends to provide a "mountaintop" definition of rural speciation patterns. Caution is needed in comparing urban sites to nearby rural counterparts (for example Washington DC to Shenandoah NP) since we don't know how much of the DC "urban excess" (at 16 meters ASL) results from Shenandoah (1100 m ASL) being often above the mixed layer – especially during winter. I emphasize this to point out a need for some rural low elevation sites – which would also be of benefit to IMPROVE, and might be best managed by adding lower elevation IMPROVE sites in a few class 1 areas.

As the number of filter-based speciation sites is reduced, and as methods changes are contemplated, I think it's possible that we might "think smarter" and squeeze additional information out of the remaining sites. For example, the Canadian NAPS speciation program (see brief summary from Tom Dann pasted at the end of my comments) measures more or less everything we do at IMPROVE and STN sites, and by fairly similar methods to ours. But in addition they denude for HNO3, SO2 and NH3 (STN does not do NH3 but should) and get (I think) better quality NH4 data than STN does. Then they extract and analyze their denuders to get HNO3, SO2 and NH3, averaged every 3rd sample day concurrent with the aerosol species. This is less desirable than the ultimate goal of continuous, but way better than monthly means. The Canadians also conduct additional analyses (on Teflon filters) for several organic ions (oxalate, formate, acetate), which in turn have proven extremely valuable for source attribution. Another difference in the Canadian protocol is that samplers are run 8AM to 8AM, rather than midnight to midnight. If loss of volatiles is a concern, this seems like a much more intelligent & efficient way of minimizing filter losses (during sampling) compared to the costly STN requirements to ship exposed filters in iced coolers.

Another example of outstanding "value added analysis" from existing (& expensively collected) filter samples is in the recent molecular carbon analysis Ted Russell's group at GA Tech has conducted on archived, composited quartz (carbon) filters from selected Eastern US STN and IMPROVE sites – followed by CMB analysis using source profiles developed with similar analytical methods. I'd like to see something like this conducted routinely (yearly with seasonal compositing), for at least a subset of remaining STN & IMPROVE sites.

On a related topic, the stated emphasis on data analysis in the NAMS proposal is much appreciated – although as usual, the funding level is minimal. A novel approach would be to develop a reasonably detailed data analysis plan in advance of conducting new measurements – and use it as a guide to what should be measured where, rather than just assuming "here are some key species and sites from which we're bound to learn something".

An aside on this, is recent (5 minutes ago) note from our colleague Husar on his latest revisions to the "Combined Aerosol Trajectory tool", which links aerosol data from the entire IMPROVE and STN networks (through the end of 2003) to associated back trajectories (ATAD model run by Kristi Gebhart at NPS) and allows all kinds of extremely powerful single and multi-site analyses – and is also really fun! (once you get the hang of it). Check it out at: http://webapps.datafed.net/dvoy_services/datafed.aspx?page=KittyC

This RPO-supported (with assistance from EPA) analysis tool is I think an excellent example of the kind of data analysis that should be routinely funded as a key component of NAMS.

4. **As EPA implements the National Ambient Air Monitoring Strategy to address multiple monitoring objectives, it will be looking to spatially *optimize* the ambient monitoring networks. This may mean that some redundant monitors in adjacent, but separate, geopolitical areas (*e.g.*, neighboring counties) are "divested" from a given network. Although technically sound, these divestments could result in data gaps which might, in turn, adversely impact regulatory decision-making. The Agency is willing to adopt alternative approaches for assessing regulatory issues such as non-attainment designations, so long as such approaches are scientifically justifiable; hence, the rationale for initiating discussion of these issues with the CASAC. Question: Is it scientifically acceptable to generate air quality surfaces through *modeled* observations and/or *integrated predictive/observational* fields that would be of appropriate uncertainty for use in the regulatory decision-making process?**

It has a stronger scientific basis than the current alternative of assuming each political jurisdiction is represented by the single monitor within it. I think much could be learned by efforts to develop and refine this king of "observation-based model", and at some point it may be appropriate to use such methods to determine compliance status. A goal would be to push toward applying such techniques in near-real-time.

Attachment 1: Summary of Canadian PM-2.5 Speciation Sampling
(for more details contact Tom.Dann@ec.gc.ca)

Fine Particle Speciation Program

Sampling Equipment and Field Operation

Sampling sites will be equipped with R&P Partisol-Plus 2025-D sequential dichot particulate samplers along with R&P Partisol Model 2300 Speciation samplers. These units share common software and data storage systems. The speciation sampler uses Harvard designed Chemcomb® cartridges which employ honeycomb glass denuders and filter packs with Teflon and Nylon media.

Both samplers have sequential sampling features and up to 32 fine and coarse filters (16 sampling days) can be preloaded in the dichot Partisol while up to 12 Chemcomb cartridges (3 sampling days) can be preloaded in the speciation sampler. At this time, the protocol will be to operate the samplers once every three days and to visit the sampling sites at least once every six days. Samples will be collected over 24 hours. One fine and one coarse filter sample will be collected on the dichot Partisol sampler and three Chemcomb cartridge samples will be collected with the speciation sampler as described below. The Chemcomb cartridges are shipped to the field completely assembled and sealed and require only mounting and leak-checking.

Field data sheets will be required but all instrument operating data will be downloaded to Palm data systems (provided) and the RAM cartridges will be returned to Ottawa with exposed samples.

Sample Types and Target Analytes

A description of the sample media and target species is provided below:

Unit	Module Description	Media	Function/Analytes
Dichot Partisol	Fine Fraction Filter	47 mm Teflon	Mass, Metals*
	Coarse Fraction Filter	47 mm Teflon	Mass, Metals
Speciation Sampler	Module A (4 components)	Sodium Carbonate Denuder	SO2 & HNO3
		Citric Acid Denuder	Ammonia
		Teflon Filter	Sulphate and other major Inorganic and Organic Ions*
		Nylon Filter	Nitrate, Sulphate
	Module B	Pre-fired Quartz Filter	Black carbon, Organic carbon
	Module C (2 components)	Teflon Filter	Mass, Metals (QA Check)
		Pre-fired Quartz Filter	Organic carbon artifact

* see next Table

Particulate matter related metals (EDXRF) and ions (IC) measured

Sulphate	Cadmium
Nitrate	Indium
Aluminum	Tin
Silicon	Antimony
Phosphorus	Tellurium
Sulphur	Iodine
Chlorine	Cesium
Potassium	Barium
Calcium	Lanthanum
Scandium	Lead
Titanium	Bromide
Vanadium	Chloride
Chromium	Nitrite
Manganese	Phosphate
Iron	Fluoride
Cobalt	Acetate
Nickel	Formate
Copper	Oxalate
Zinc	Sodium
Gallium	Magnesium
Germanium	Cerium
Arsenic	Praseodymium
Selenium	Neodynium
Bromine	Tantalum
Rubidium	Tungsten
Strontium	Mercury
Yttrium	Thallium
Zirconium	Bismuth
Niobium	Sodium
Molybdenum	Ammonium
Palladium	Silver

Mr. George Allen

To: Fred Butterfield, Designated Federal Officer
EPA SAB, Clean Air Scientific Advisory Committee (CASAC)
Ambient Air Monitoring and Methods Subcommittee

From: George Allen, AAMM subcommittee member, December 20, 2004

The following are revised written comments for the December 15 meeting on "Implementation Aspects of EPA's Final Draft National Ambient Air Monitoring Strategy (NAAMS)". A copy of these comments is being sent to Dr. Phil Hopke, CASAC AAMM Subcommittee Chair. These comments address the four "Charge" questions in the EPA OAQPS memo to the SAB dated November 19, 2004, and additional NAAMS topics brought up during the meeting.

Charge Question #1. The five PM precursor gases listed here (CO, SO_2, NO/NO_y, NH_3, HNO_3) are useful to have at Level 2 NCore sites to aid in understanding the sources, transport, transformation and fate of these PM-relevant species. The first three pollutants listed here are likely to be enhancements to existing measurements, not additional measurements. The need for significant training resources is still important however, since practices for measurement, data acquisition, and data validation that are adequate for compliance-oriented monitoring often need substantial modification for "trace-level" monitoring purposes.

At least for urban sites (which make up the vast majority of Level 2 sites), it may be worth considering the use of NO and "true" NO_2 instead of NO_y (or in addition to for NO_z). Photolytic "true" NO_2 methods are now becoming practical for routine monitoring, using near-UV LED converter technologies; for an example see: Buhr, US Patent Application # 20040108197 at http://appft1.uspto.gov/netahtml/PTO/srchnum.html .

Monthly duration measurements of NH_3 and HNO_3 are of very limited value; as noted in the meeting, 12 daily samples/year would be more useful. Where possible, I would like to encourage the use of real-time methods (hourly or shorter measurement periods) rather than daily (24-hour) duration integrated filter measurements for these gases. Daily measurements smear important temporal patterns, and make it difficult to understand the underlying dynamics of these gas phase PM precursors (similar to trying to understand ozone dynamics and chemistry using a daily 24-hour value). Real-time methods for measurement of these gases at ambient concentrations are becoming more practical and may be cost-effective in the longer run.

A network of Level 2 sites that measures these enhanced PM precursor gases begs the question of can we also afford real-time PM speciation measurements (for carbon, nitrate, and sulfate) at these sites? The value and rationale for these real-time measurements are the same as for NH_3 and HNO_3 above. Keeping in mind the pyramid (not a wedding cake) NCore approach, these enhanced non-NAAQS parameters could be made in or near areas where PM2.5 compliance is an issue, but not at all Level 2 urban sites. Another option could be to not deploy all of these additional measurements as a suite, but to measure nitrate-related pollutants in areas where nitrate is a substantial contributor to PM2.5, and

SO_2/SO_4 where sulfate is a substantial contributor. In urban areas, carbon always is a major contributor of course. Rural Level 2 sites should always have as complete a suite of measurements as possible, to address a wide range of transport issues. The concept of a subset of enhanced Level 2 sites ("Level 1.5") with some or all of the real-time parameters discussed here becomes more important if Level 1 sites continue to remain unfunded in the final NAAMS regulations.

I recommend that OAQPS require some performance-based acceptance process similar to the existing reference or equivalent method designation used for NAAQS pollutants for these methods even though the monitoring goal is not compliance with NAAQS and some of these parameters are not NAAQS pollutants. An example of the need for this non-NAAQS based performance review is the NO interference on trace SO2 analyzers; some vendors historically have traded a five-times worse NO rejection ratio for a better SO2 sensitivity specification, rendering the method potentially useless in urban areas.

Training is a critical component as new measurement methods and technologies are widely implemented. The concept of an annual "National Monitoring Conference" (replacing and expanding SAMWG) would be a good venue to use for training, from both vendors and experts in the monitoring community (to give a user perspective). Regional versions of this can also be effective, for example the joint MARAMA-NESCAUM continuous PM2.5 training session planned for spring 2005. I discourage wide use of satellite-based training, since access to it is relatively limited at the local agency level and it expensive in the context of current technologies; web-based training, downloadable or streaming video training, and web-based video-conferencing are all more cost effective and widely accessible remote training alternatives.

Charge Question #2. One approach to integration of these data into research programs is to work with non-EPA funding agencies like DOE, HEI and NIEHS to insure their program funding opportunities emphasize the leveraging of existing data. One recent example of this is the HEI program to make STN and related data more accessible to those doing health effect research. If Level 1 sites are ever implemented, it is essential that these sites be partnerships between research institutions and local air agencies, and not stand-alone research programs. The technology transfer process and program relevance to the local agencies are greatly enhanced by these partnerships. One recent example where this has worked well is the NYC PM-Supersite.

Charge Question #3. It is critical to harmonize the STN and IMPROVE networks as much as practical, since it's difficult to perform analysis on a combined urban/rural data set when much of the data from these two networks are often not directly comparable. I recommend modifying STN field, laboratory (carbon, ions, and XRF-elements), and data handling (validation, uncertainty reporting, below MDL treatment) protocols to bring them as close as possible to those of the IMPROVE network, consistent with the current EPA plans to convert STN to the IMPROVE TOR carbon analysis method. Regardless of the debatable merits of either network, IMPROVE has a much longer measurement history and is a regulatory trend network for the regional haze regulations; as such it can

not be easily changed. It may not be necessary to convert all of STN to IMPROVE sampler hardware, and it is probably not practical to have the IMPROVE program simply "take over" the STN operations. However some consideration should be given to reducing the variability of sampler types across STN, and in the process minimize the major differences between IMPROVE and STN samplers. Filter face velocity differences for carbon is an example of sampler parameters that could cause differences across or within networks. Post-filter handling (time on sampler, stored/shipped cold or warm) is an example of a "method" parameter variable that is not related to either sampler type or analytical method.

There was a brief discussion of the value of ammonium ion measurements in a speciation network (IMPROVE or STN). While I agree those data are useful, I do not see a practical way of getting valid ammonium ion data from either the Teflon or Nylon filters in these networks in environments where ammonium nitrate is a dominant contributor to the ammonium ion concentration. Nitrate losses from Teflon filters is substantial and well characterized. Even though they retain ammonium nitrate well, based on the chemistry there is no reason to believe that Nylon filters quantitatively retain ammonium ion from ammonium nitrate; since the Nylon filter media is basic it is likely that much or all of the ammonium ion is lost as NH_3. If ammonia is properly removed upstream of the filter, ammonia lost from the Nylon filter could be measured down-stream, but this requires significant sampler changes, additional filter extraction and analysis, and has the potential for substantial surface losses of the volatilized ammonia within the sampler.

Charge Question #4. Generating ambient air quality surfaces by modeling processes or interpolation between monitors can be useful in some situations, such as reducing exposure mis-classification for health effects studies. In a NAAQS compliance context, this approach may have limited value given the state of air pollution modeling science. The uncertainties in modeled or interpolated pollutant concentrations that are acceptable for epidemiological studies may be too large for "bright-line" regulatory issues such as non-attainment designation. The potential value for this approach may be limited to areas that are expected to be both reasonably spatially uniform for the pollutant of interest and where expected concentrations based on nearby monitoring sites are not near any regulatory value -- e.g., either well above or below a NAAQS standard.

There was substantial discussion during the meeting about the value of the PAMS network data to date, and the network's future design. The concept of replacing many of the PAMS sites with non-methane hydrocarbon real-time measurements (as California has done) is worthy of further consideration; NMHC could serve as a general trends indicator for PAMS parameters. The PAMS approach may have substantial value in urban "enhanced" Level 2 NCore sites, run year round for air toxics and PM-precursor use, in addition to the classic "summer only" ozone-centric operation. The new New Haven CT Crisculo Park site is an example where this has recently been implemented.

Dr. Judith Chow

December 13, 2004

To: Fred Butterfield, Designated Federal Officer,
Clean Air Scientific Advisory Committee (CASAC)
From: Judith C. Chow, Research Professor, Desert Research Institute
CC: Phil Hopke, CASAC Ambient Air Monitoring and Methods (AAMM) Subcommittee Chair

Subject: CACAS AAMM Subcommittee Charge on the Evaluation of the Final Draft of the National Ambient Air Monitoring Strategy (NAAMS) document dated April 2004

The staff of the Office of Air Quality Planning and Standards did a remarkable job of assembling the final draft National Ambient Air Monitoring Strategy (NAAMS) document and responses to the 164 comments in the Addendum of the Strategy document. Conceptually, the NCore strategy represents a major change from what has been done over the past 30 years. Its success or failure will depend on building flexibility into, while establishing consistency within, the current monitoring network. EPA is facing major challenges in coming years to assure that data from the restructured NCore network will achieve the objectives for compliance and implementation of air quality standards, air quality forecasting, atmospheric processes research, and the determination of health, visibility, ecological, and radiative effects. The following review focuses on the four assigned questions, with additional comments on NCore siting, Level 1 sites, and measurement methods.

Question 1. *Given limited budgetary resources, does this represent both an appropriate and adequate balance, as reflected by the relative resource allocations provided in Section 11, "Draft Implementation Plan," of the Final Draft NAAMS Document? In addition, are the relative adjustments in the training and guidance approaches proposed in the draft implementation plan consistent with the overall objectives of the Strategy?*

Table 11-3 listed the proposed redistribution of Federal resources for ambient monitoring. It is difficult to evaluate resource allocation without adequate background on how these estimates were formulated. It would be helpful to document the cost-estimation basis in categories of: 1) initial hardware procurement; 2) initial installation and shakedown; 3) initial training; 4) spare parts; 5) repairs; 6) normal operations labor; 7) rent/power/security; 8) quality control and auditing; and 9) data processing and management. Based on my calculation, the allocation is estimated on an average of ~$60,000 per Level 2 NCore site, including capital investments for equipment purchases and associated operating expenses, and $50,000 to $100,000 per Level 3 NCore site, depending on whether ~1,000 or 500 sites are planned. (Richard Scheffe's presentation and Figure 4-1 show >500 Level 3 sites. But Section 4.3.5 [p. 4-10] shows ~1,000 sites.) Even if one factors in the infrastructure of the Level 2 site as being mostly established, resource allocation to the Level 3 sites seems high. This defeats the objectives of the Level 3 sites, which focus on a subset of criteria pollutants (e.g., PM and O_3).

While the training and guidance approach proposed in the draft implementation plan is consistent with the overall objectives of the Strategy, the resource allocation seems low. Given a total of

$198.85 million (note that there is an error in the proposed budget sum), the allocations of 1.6% ($3.2 million) to quality assurance (QA) and 0.1% ($200,000) to training are low, even though they are additions to the current budget.

The performance evaluation program (PEP) in Table 7-3 estimates $3.6 million in QA— $0.4 million higher than the Table 11-3 estimate, of which ~60% is allocated to $PM_{2.5}$ PEP and speciation. Listings of the current State and Tribal Air Grant (STAG) fund ($2.3 million in Table 7-3 and $1.9 million in Table 11-3) are also different. What about QA for existing PM_{10}, future PM_{coarse}, newly added HNO_3 and NH_3, and NO_y measurements, and audits for meteorological measurements? Even though some of the training and QA needs arising from the network modification may be embedded into each pollutant category, the level of effort needed for QA and training (probably at multiple locations) seems to be underestimated, especially for the first 2–5 years, during the transitional period.

The certification program is a good approach for ensuring consistent data quality. More detail is needed on traceability from common primary standards, to transfer standards, and to in-station QA standards. This is especially important for the non-standard measurements (e.g., PM, NH_3, NO_y). There is a need for guidance to clearly state the corrective action for sites that fail to pass the certification tests. More centralized QA, as recommended by the CASAC NAMS subcommittee, with consistent, clearly stated data validation criteria and data formats, is a good target.

It is encouraging to see "data analysis and interpretation" listed as a separate line item, even though it accounts for only 1.1% ($2.2 million) of the total budget. If funding is available for data analysis, a detailed data analysis plan is needed to specify data analysis objectives that analyze pollution characteristics and trends, identify episodes, explore seasonal/annual trends and spatial variations, develop control strategies, track progress of control measures, estimate source attribution, as well as evaluate emissions inventory and air quality models (Chow et al., 2002a). These analyses should be the tools that identify the needs to further refine the network to meet multiple objectives (U.S. EPA, 1997a).

What Table 11-3 lacks (which may be embedded in network operations) are resources for different levels of data validation. In the long run, it is more cost-effective to replace filter-based measurements with in-situ continuous monitoring. The initial cost of the switch-over is high, and continuous instruments are more labor-intensive in the field for routine calibration and maintenance, and in the office for processing and evaluating short-term average (1- to 5-minute) measurements. Substantial effort is needed for timely data validation to resolve data outliers and to take necessary corrective actions to minimize the generation of additional invalid or suspect data. Four levels or categories generally apply to validation of monitoring data (Chow et al., 2002b):

Level 0	Raw data right off the instrument (used for real-time alerts and forecasting).
Level I	Routine checks made during the initial data processing and generation of data, including proper data file identification, review of unusual events, review of field data sheets and result reports, instrument performance checks, and deterministic relationships.
Level II	Tests for internal consistency to identify values in the data which appear atypical when compared to values of the entire data set.
Level III	Comparison of the current data set with historical data to verify consistency over time. Tests for parallel consistency with data sets from the same population (region, air mass, period of time, etc.) to identify systematic bias. This level can be considered as part of the data interpretation or analysis process.

Note that Level III, and possibly Level II, data validation are part of the data analysis and interpretation process and may be grouped to the data analysis categories and allocated as Research and Development rather than as monitoring funds. While it is desirable to have data available soon after its collection—and real-time monitors permit this on a local basis—current regulations requiring "submission to EPA 90 days after the calendar quarter in which the sample was collected" are reasonable. This allows state and local agencies to conduct Levels 0 and I data validation and to perform cross-comparisons to remove invalid data and flag suspect data.

The zero sum approach is challenging during the transition period since substantial costs may be incurred for equipment procurement, operator training, and comparability testing (to retain continuity with previous data). I disagree that a data validation protocol should be developed by the modeling community (p. 26, response to Comment 127 of the Addendum). For advancement, data validation protocols should benefit from lessons learned from those who conduct the field measurements; modelers are not necessarily familiar with these measurements.

Question 2. *Does the Subcommittee have additional suggestions for addressing this need for integration and communication to the broader community of "users," including scientific researchers (i.e., human health, atmospheric, ecological) and State, local and Tribal (SLT) Agency representatives? More specifically, what is the most effective manner for EPA to both reach out to this broad user community and, where appropriate, to incorporate their feedback and design input on such issues as monitoring site locations and parameters?*

The Strategy formulates several good means (i.e., fact sheets, quarterly newsletters, presentations, and brochures) for public outreach. However, from the public comment process (p. 9-4), it is clear that less than ~10% of the local and state and 30% of the regional offices responded during the comment period, with only two comments each from the public interest groups and industry, and one from the tribes. It appears that it did not call enough attention to those agencies that would be directly impacted by the proposed Strategy, and the 164 questions raised may not be representative of the general population. More aggressive solicitation of

comments is needed from the research community or data users in the field of atmospheric, health, and ecological sciences. One good approach might be to put a notice on popular real-time web sites (e.g., AIRNow) where people go to make decisions based on air quality data.

The majority of epidemiological studies rely on data from long-term compliance networks for exposure assessment (Vedal, 1997). A need still exists to broaden the involvement of air quality and health researchers to optimize the restructured national network while meeting the current resource constraints.

If additional support can be obtained, the research community can assist in developing data validation protocols, conducting data analysis, and evaluating the representativeness of the NCore sites. As pointed out by Demerjian (2000), there is a need to develop appropriate feedback between the measurement community and data analysts to assure data quality and data applicability. This feedback should also cover additional data management issues, such as data and metadata items and report formats to facilitate data analysis and interpretation.

Question 3. *What are the strengths and weaknesses of converting all of the Speciation Trends Network (STN) speciation sites to Interagency Monitoring of Protected Visual Environments (IMPROVE) samplers and IMPROVE laboratory and sample handling protocols?*

The lack of consistency between the IMPROVE and STN networks is a major shortfall, since the two networks use different requirements for sample archiving, field blank collection, shipment, blank subtraction, carbon analysis (Chow et al., 2001, 2004), and uncertainty estimation (NRC, 2004). Converting all STN sites to IMPROVE sites has the following advantages:

Data consistency:	A national approach is needed for field sampling, laboratory analysis, and sample validation to ensure the consistency of data quality. Switching STN over to the IMPROVE protocol would minimize the discrepancies between the two current networks. This will allow model comparison and evaluation between urban and non-urban areas. Archived samples in the IMPROVE network have been shared with the research community in the United States and foreign countries or to be stored for special studies.
Cost savings:	IMPROVE samplers have been proven to be robust and easy to operate since 1987-88. Recent modifications have further advanced their utility. With the exception of capital investment for IMPROVE samplers, the operating cost for STN following the IMPROVE protocol can be substantially reduced. Approximately 80–90% of the current STN network uses Met One speciation samplers (Met One Instruments, Inc., Grants Pass, OR), which are labor intensive for filter loading and unloading. Shipping costs could also be substantially reduced due to the stainless steel housing of the Met One sampling cartridge. The pros and cons of cold shipping requirements in the STN but not the IMPROVE network also warrant further evaluation.

Long-term value:	More than 100 publications have used IMPROVE data to evaluate measurement systems, map spatial distributions, develop and apply source apportionment models, and make important control strategy decisions (e.g., Malm et al., 1989; Pitchford et al., 1999). The IMPROVE network is just completing the baseline period required by the regional haze rule (U.S. EPA, 1999; Watson, 2002) and cannot experience major changes without substantial comparability testing. The STN has no such requirements.

Question 4. *Is it scientifically acceptable to generate air quality surfaces through modeled observations and/or integrated predictive/observational fields that would be of appropriate uncertainty for use in the regulatory decision-making process?*

Currently, network assessment starts at the national level. It uses interpolating methods between measurements sites and uses error analysis to remove redundant sites. This type of spatial analysis is adequate for flat terrain with a sufficient number of sites. It also works to evaluate whether one site is redundant with other sites. It cannot extrapolate concentrations into areas with insufficient monitoring. A good illustration is the IMPROVE network, where the addition of Midwestern sites in 2001 revealed a large nitrate cloud that was not evident from the earlier network. Integrated predictive/observational fields with adequate uncertainty estimates outweigh any single modeling approach. Relying on modeled results alone may bias the decision-making process.

As pointed out in a recent National Research Council (NRC) report (NRC, 2004), the enhanced network should have the following three characteristics: 1) use continuous measurements of appropriate indicators with real-time access; 2) represent less uniform micro- and middle-scale exposures; and 3) encourage the development and use of continuous monitors for indicators other than mass concentration. For areas that may have concentration gradients between the Level 2 or 3 sites (i.e., not representative of micro- or middle-scale exposure), additional monitors may be needed. In these cases, dense spatial monitoring (e.g., Chow et al., 1999, 2002c) over a short period of time (e.g., 2–4 weeks) is needed to add or remove sites, to assure adequate spatial coverage, or to confirm observational or diagnostic modeling results. The "zone of representation" experiments could be economically executed with portable instruments (e.g., Fujita et al., 2003). Their lower precision is still adequate to determine large spatial gradients.

Instrumentation used at Level 3 sites should be required (not "strongly encouraged", as stated on p. 4-10) to be collocated with filter-based measurements for a set period of time to ensure equivalence or comparability. Current requirements for the $PM_{2.5}$ Federal Equivalent Method (FEM) are: 1) collocated precision of 2 $\mu g/m^3$ or 5% (whichever is larger); 2) linear regression slope of 1 ± 0.05; and 3) linear regression intercept of 0 ± 1 $\mu g/m^3$ and correlation coefficient (r) of 0.97 (U.S. EPA, 1997b). For Regional Equivalent Monitors (REM), the proposed performance criteria are bias (relative to a filter-based Federal Reference Method [FRM]) ± 10%, collocated precision (continuous monitors) <10% of coefficient of variance (CV), with r of 0.93. These criteria are too stringent to be met for currently available PM speciation monitors. I disagree with relying on vendors to demonstrate equivalence (p. 20, response to Comment 92 of Addendum) since comparability between instruments varies by location due to changes in emissions, meteorology, and aerosol composition. There are only limited comparisons that can be supported

by vendors. Depending on the complexity of the surrounding environment at Level 3 sites, equivalence, comparability, or predictability (Watson and Chow, 2002) between the testing instrument and the FRM should be established at each location for realistic comparison. Methods with acceptable comparability should be allowed to facilitate the network transition. Level 3 sites should also be used to understand the impact from source-oriented location (e.g., Zhu et al., 2002a, 2002b) and concentration gradients between the Level 2 sites.

The Strategy document calls for multi-level network assessment every 5 years (Section 5). It appears that a top-down approach is taken in that the national assessment is conducted prior to regional or state/local assessment. In addition, the zero-sum approach is at the national level. What will the incentive be for state/local agencies to voluntarily reduce their sites, consequently cutting off their 103 grants and possibly having to reduce staffing? Is the Regional Assessment Guideline Document that is expected to be completed by September 2004 (p. 5-6) available? Were consistent statistical methods used at different levels of assessment? Step 3 in the Statistical Analysis (under Section 5.4, Guidance for Future Regional Network Assessment) and examples found at http://www.epa.gov/ttn/amtic/netamap.html are helpful, but specific criteria are needed for national consistency.

Additional Comments

NCore Siting

U.S. EPA Guidance for Network Design and Optimum Site Exposure for $PM_{2.5}$ and PM_{10} (U.S. EPA, 1997a) defines the following steps for community-oriented core sites and optional community monitoring zones (CMZ): 1) locate emission sources and populations; 2) identify meteorological patterns; 3) compare PM concentrations; 4) adjust CMZs to jurisdictional boundaries; and 5) locate sites. These criteria should be considered for NCore siting rather than relying on an "NCore design committee" (p. 4-12).

It is not clear how "Nearly 80 'representative' air quality regions that group populations based on statistical geographical factors …" (p. 4-11) were formulated for epidemiological studies, and how "24 rural locations" were selected to support Community Modeling Air Quality System (CMAQS) model evaluation. A total of 75 NCore Level 2 sites ranging from rural to urban areas across all 50 states appears to be inadequate for human exposure assessment. In addition to population density, source emissions, terrain features, and meteorological characteristics should be factored in. A drastic reduction of speciation sites without adequate analysis of the chemical composition data at the existing sites seems premature. Sites with long-term historical databases and stable infrastructures are valuable for trend analyses and network design.

Level 1 NCore Sites

Much emphasis was given to the importance of Level 1 sites, but resources are insufficient. I do not believe that Level 1 sites should be operated by EPA contractors or academia, or only for short-term durations as suggested in the Strategy document (p. 4-7). One of their goals should be to demonstrate how new instrumentation might be used at Level 2 sites. Investment to be made in Level 1 sites, such as instrument procurement, trained operators, and the establishment of

information technology for data transfers, requires a long-term commitment. For example, the Fresno Supersite began operating around mid-1999 and has continued to be operated by the California Air Resources Board (ARB) for more than 5 years. Several vendors, government agencies (e.g., Battelle's Pacific Northwest National Laboratory), and academia (e.g., University of California, Davis; University of California, Berkeley; and Brigham Young University) have benefited from using the Fresno Supersite sampling platform for method testing and for research. Concurrent epidemiological studies (i.e., FACES, Fresno Asthmatic Children's Environment Study) have been conducted by taking advantage of 5-minute average continuous measurements and 24-hour integrated chemical composition data acquired at the Supersite. As stated on p. 4-15, Level 1 sites should be an integral long-term network component and operate with greater inter-site consistency. Therefore, Level 1 sites should follow the same data validation and data submittal criteria, and should be inclusive of Level 2 site's measurements.

Measurements at NCore Sites

Inconsistent NO or NO_2 measurements have been listed throughout the Strategy document that need to be clarified. I question the utility of month-long averaged NH_3 and HNO_3 measurements. What kind of denuders can accommodate such a wide range of concentration levels for NH_3 and HNO_3 without breakthrough? HNO_3 is a very unstable gas and might shift its equilibrium state with particles under high temperatures. What will a month-long measurement or 12 samples per year at 75 locations represent? Ideally, these measurements should be an integral part of the speciation sampler. Or, at a minimum, they should be collected on a 24-hour basis corresponding to one or several of the 24-hour speciation samples to understand the gas-to-particle relationship. In fact, shorter averaging intervals (~1 to 3 hours) are desired for precursor gases to better understand the gas-to-particle equilibrium under different temperatures and relative humidities. These measurements may be considered as part of short-term special studies.

To facilitate the transition from filter-based speciation measurements to in-situ continuous mass and chemical measurements (e.g., $SO_4^{=}$, $NO_3^{=}$, carbon) requires a collocated comparison to ensure the equivalence or comparability between the measurements (Fehsenfeld et al., 2003). Recent comparisons (e.g., Drewnick et al., 2003; Fine et al., 2003; Weber et al., 2003; Harrison et al., 2004) show that commercially available instruments still need to be modified to demonstrate equivalence or comparability.

References

Chow, J.C.; Watson, J.G. Guideline on speciated particulate monitoring; prepared for U.S. EPA, Research Triangle Park, NC, by Desert Research Institute: Reno, NV, 1998. www.dri.edu.

Chow, J.C.; Watson, J.G.; Green, M.C.; Lowenthal, D.H.; DuBois, D.W.; Kohl, S.D.; Egami, R.T.; Gillies, J.A.; Rogers, C.F.; Frazier, C.A.; Cates, W. Middle- and neighborhood-scale variations of PM_{10} source contributions in Las Vegas, Nevada; JAWMA 1999, 49(6), 641-654.

Chow, J.C.; Engelbrecht, J.P.; Watson, J.G.; Wilson, W.E.; Frank, N.H.; Zhu, T. Designing monitoring networks to represent outdoor human exposure; Chemosphere 2002a, 49(9), 961-978.

Chow, J.C.; Engelbrecht, J.P.; Freeman, N.C.G.; Hashim, J.H.; Jantunen, M.; Michaud, J.P.; de Tejada, S.S.; Watson, J.G.; Wei, F.S.; Wilson, W.E.; Yasuno, M.; Zhu, T. Chapter one: exposure measurements; Chemosphere 2002b, 49(9), 873-901.

Chow, J.C.; Watson, J.G.; Edgerton, S.A.; Vega, E.; Ortiz, E. Spatial differences in outdoor PM_{10} mass and aerosol composition in Mexico City; JAWMA 2002c, 52(4), 423-434.

Chow, J.C.; Watson, J.G.; Chen, L.-W.A.; Arnott, W.P.; Moosmüller, H.; Fung, K.K. Equivalence of elemental carbon by thermal/optical reflectance and transmittance with different temperature protocols; Environ. Sci. Technol. 2004, 38(16), 4414-4422.

Demerjian, K.L. A review of national monitoring networks in North America; Atmos. Environ. 2000, 34(12-14), 1861-1884.

Drewnick, F.; Schwab, J.J.; Hogrefe, O.; Peters, S.; Husain, L.; Diamond, D.; Weber, R.; Demerjian, K.L. Intercomparison and evaluation of four semi-continuous $PM_{2.5}$ sulfate instruments; Atmos. Environ. 2003, 37, 3335-3350.

Fehsenfeld, F.C.; Hastie, D.R.; Solomon, P.A.; Chow, J.C. Chapter 5: Gas and particle measurements, in Particulate Matter Science for Policy Makers, A NARSTO Assessment, Part 2; NARSTO: Pasco, WA, 2003, pp. 5-1-5-37.

Fine, P.M.; Jaques, P.A.; Hering, S.V.; Sioutas, C. Performance evaluation and use of a continuous monitor for measuring size-fractionated $PM_{2.5}$ nitrate; Aerosol Sci. Technol. 2003, 37(4), 342-354.

Fujita, E.M.; Watson, J.G.; Chow, J.C.; Zielinska, B.; Islam, M. Demonstration PM Study Plan for Pune, Maharastra, India; prepared for U.S. Environmental Protection Agency Office of International Affairs; Desert Research Institute: Reno, NV, 2003.

Harrison, D.; Park, S.S.; Ondov, J.; Buckley, T.; Kim, S.R.; Jayanty, R.K.M. Highly time resolved fine particle nitrate measurements at the Baltimore Supersite; Atmos. Environ. 2004, 38(31), 5321-5332.

Malm, W.C.; Pitchford, M.L.; Iyer, H.K. Design and implementation of the Winter Haze Intensive Tracer Experiment – WHITEX, in Transactions, Receptor Models in Air Resources Management, Watson, J.G., Ed.; Air & Waste Management Association: Pittsburgh, PA, 1989, pp. 432-458.

National Research Council of the National Academies. Research priorities for airborne particulate matter: IV. Continuing research progress; The National Academy Press: Washington, DC, 2004. www.nap.edu.

Pitchford, M.L.; Green, M.C.; Kuhns, H.D.; Tombach, I.H.; Malm, W.C.; Scruggs, M.; Farber, R.J.; Mirabella, V.A.; White, W.H.; McDade, C.; Watson, J.G.; Koracin, D.; Hoffer, T.E.; Lowenthal, D.H.; Vimont, J.C.; Gebhart, D.H.; Molenar, J.V.; Henry, R.C.; Eatough, D.A.; Karamchandani, P.K.; Yang, Z.; Seigneur, C.; Eldred, R.A.; Cahill, T.A.; Saxena, P.; Allan, M.A.; Yamada, T.; Lu, D. Project MOHAVE, Final Report; U.S. Environmental Protection Agency, Region IX: San Francisco, CA, 1999.

U.S. EPA. Guidance for network design and optimum site exposure for $PM_{2.5}$ and PM_{10}; EPA-454/R-99-022; US EPA, 1997a.

U.S. EPA. Revised requirements for designation of reference and equivalent methods for $PM_{2.5}$ and ambient air surveillance for particulate matter – final rule; Federal Register 1997b, 62(138), 38763-38854.

U.S. EPA. 40 CFR Part 51 – Regional haze regulations: Final rule; Federal Register 1999, 64(126), 35714-35774.

Vedal, S. Critical review – Ambient particles and health: Lines that divide; JAWMA 1997, 47(5), 551-581.

Watson, J.G. Visibility: Science and regulation; JAWMA 2002, 52(6), 628-713.

Watson, J.G.; Chow, J.C. Comparison and evaluation of in-situ and filter carbon measurements at the Fresno Supersite; J. Geophys. Res. 2002, 107(D21), ICC 3-1-ICC 3-15.

Weber, R.; Orsini, D.; Duan, Y.; Baumann, K.; Kiang, C.S.; Chameides, W.; Lee, Y.N.; Brechtel, F.; Klotz, P.; Jongejan, P.; ten Brink, H.; Slanina, J.; Boring, C.B.; Genfa, Z.; Dasgupta, P.; Hering, S.; Stolzenburg, M.; Dutcher, D.D.; Edgerton, E.; Hartsell, B.; Solomon, P.A.; Tanner, R. Intercomparison of near real time monitors of $PM_{2.5}$ nitrate and sulfate at the U.S. Environmental Protection Agency Atlanta Supersite; J. Geophys. Res. 2003, 108(D7), SOS 9-1-SOS 9-13.

Zhu, Y.F.; Hinds, W.C.; Kim, S.; Shen, S.; Sioutas, C. Study of ultrafine particles near a major highway with heavy-duty diesel traffic; Atmos. Environ. 2002a, 36(27), 4323-4335.

Zhu, Y.F.; Hinds, W.C.; Kim, S.; Sioutas, C. Concentration and size distribution of ultrafine particles near a major highway; JAWMA 2002b, 52(9), 1032-1042.

Mr. Bart Croes

U.S. EPA's National Ambient Air Monitoring Strategy Implementation

December 15, 2004 Consultation Meeting

CASAC AAMM Subcommittee Review Comments, Bart Croes

Overall, the Strategy document represents a welcome initiative by U.S. EPA to rethink the nation's approach to ambient air quality monitoring in partnership with state, local and tribal (SLT) agencies. The document provides a thorough description of the ad hoc process that led to the current national air monitoring networks, explains why the networks need to be more integrated and adaptable to changing needs, and provides a reasonable rationale for the many proposed changes. I appreciate the degree to which U.S. EPA has responded to comments from the CASAC NAAMS Subcommittee and others. My comments address the four charge questions posed by Rich Scheffe in his November 19, 2004 memo to Fred Butterfield.

***Question 1:* Given limited budgetary resources, does the network redesign represent both an appropriate and adequate balance, as reflected by the relative resource allocations provided in Section 11, "Draft Implementation Plan," of the Final Draft NAAMS Document? In addition, are the relative adjustments in the training and guidance approaches proposed in the draft implementation plan consistent with the overall objectives of the Strategy?**

My comments are based on the premise that public health (and welfare) considerations should inform the priority and funding allocation for what is measured, and that all measurements must have clients that will use the data for their intended purpose.

The proposed future resource allocation (Table 11-3) has the right order in terms of the relative priority of PM, ozone, and TACs. In California, we estimate 400 annual Statewide cancer cases attributable to all TACs (primarily diesel PM, benzene, and 1,3-butadiene) versus 6,500 deaths per year related to PM2.5 and 640 deaths per year for ozone. PM2.5 and PM10 are responsible for the majority of the morbidity effects. The TAC mortality estimate is an overestimate since it uses the 95% upper confidence limit while the PM2.5 mortality estimate could be up to three times higher because there may not be a threshold. Thus, PM represents 80-90% of the known health risk attributable to ambient air pollution and rightly deserves the majority of resources.

I recommend that U.S. EPA drop the PAMS VOC monitoring requirements entirely, as the vast amounts of data collected each summer do not appear to have a client. Data collected in California has had very little utility for trend analyses, emission inventory reconciliation, or air quality model input and evaluation. A strategy of continuous NMVOC mass measurements (for trends to check on the success of control programs and ozone data analysis), and VOC speciation during special studies of ozone episodes likely to be used in SIP modeling, is sufficient. This would save at least $10 M

that can be devoted to data analysis and interpretation (proposed for only $2.2 M), baseline funding of the Level 1 sites, enhancement of the Level 2 sites, and environmental justice-oriented monitoring.

Perhaps the resources ($10 M) devoted to PMc monitoring can be minimized. U.S. EPA and SLT agencies have already invested huge resources into the current PM10 and PM2.5 monitoring networks. Several states (i.e., California) have State ambient air quality standards for PM10 and do not plan to follow U.S. EPA in adopting a coarse particle standard. Surely if a site meets the PMc standard with PM10 monitoring data (uncorrected), then there is no need to deploy a PMc-specific monitor at the site. While U.S. EPA has not yet promulgated a coarse particle NAAQS, it has released a Staff Paper with a proposed range of possible standards for PM2.5 and PMc. As a first-order estimate, data from the existing PM10 monitoring network should be compared to the proposed lower and upper ranges of the coarse particle recommendations to determine if the potential scope of a PMc monitoring network would be national in scale or restricted to a few states. In these likely non-attainment areas, PM10 would primarily consist of the coarse fraction. Sites that have collocated PM2.5 and PM10 monitors or SLT agencies that have operated dichot samplers (e.g., California) provide more relevant data for this screening analysis.

The revised Strategy places importance on the Level 1 sites, but needs to devote resources to the effort (with perhaps matching funds from SLT agencies and industry). Level 1 sites can serve as a test bed for Level 2 instrumentation, and can appropriately by operated by highly trained SLT agency personnel. This approach has worked extremely well at the Fresno PM Supersite, with operations by the California Air Resources Board and funding from U.S. EPA. Major yearlong air quality field studies (CRPAQS, CCOS), atmospheric researchers (BYU, DRI, UCB, UCD, UCSD), government agencies (PNNL, U.S. EPA), and a major $7 M health study (i.e., Fresno Asthmatic Children's Environment Study) have benefited from the Supersite.

The Level 2 sites should include continuous NMVOC (for trends to check on the success of control programs and ozone data analysis) and CO_2 (for fuel-based emission inventories that are a good check on MOBILE and EMFAC). Sites coordinated with health studies should include particle counts or surface area to check health hypotheses and because they do not necessarily correlate with PM mass like so many PM components. Some of the Level 2 sites should be located for special purposes. These include roadway or tunnel sites (to measure the success of the motor vehicle control program), sites to document Asian and Saharan dust events, global O_3 trends, and conditions aloft (instrumented buildings).

Environmental justice concerns need some funding. Screening methods (i.e., low-cost, easy-to-use monitoring technologies) should be developed and deployed to assess near-source exposures in low-income communities and communities of color. Relatively low-cost passive monitoring technologies exist for O_3, NO_2, BTEX, and HCHO, and portable samplers are available for CO and PM. These are not FRM-equivalent devices, but should be suitable for screening purposes.

<u>Question 2:</u> Does the Subcommittee have additional suggestions for addressing the need for integration and communication of the NCore Level 2 network to the broader community of "users," including scientific researchers (i.e., human health, atmospheric, ecological) and State, local and Tribal Agency

representatives? More specifically, what is the most effective manner for EPA to both reach-out to this broad user community and, where appropriate, to incorporate their feedback and design input on such issues as monitoring site locations and parameters?

It is disappointing to read that only 29 comment letters were submitted on the September 2002 draft Strategy document, although that does not necessarily reflect poorly on U.S. EPA public outreach process. However, as an active member of NARSTO and an attendee at the annual conferences of the Health Effects Institute, I am not aware that NAAMS was presented to these broad stakeholder communities. Perhaps a more active effort is needed to identify organizations, conferences, journals, and other publications where U.S. EPA staff can present the Strategy.

If it has not already been done, an email list-serve should be developed and advertised on U.S. EPA's monitoring-related websites. I know that Region 9 has a distribution list of SLT representatives, and other regions likely do as well, that can serve as a starting point. The list-serve can be used to release the final Strategy and periodic guidance documents, and to solicit reviews.

A useful product to circulate widely is the maps and summaries of existing networks contained in Chapter 3. A recent effort by epidemiologists at New York University to do national source apportionment maps only found one California STN site in AIRS. There are many more sites as part of STN, IMPROVE, and other networks, and easy-to-access network summaries with points of contact will increase the use of network data.

<u>Question 3:</u> EPA is considering converting all of the Speciation Trends Network (STN) sites to Interagency Monitoring of Protected Visual Environments (IMPROVE) samplers and IMPROVE laboratory and sample handling protocols. What are strengths and weaknesses of this approach?

There would be clear benefits from consistent sampling, analysis, data handling, and quality assurance protocols for the STN and IMPROVE networks. My group is a major user of speciation data for PM SIPs, Asian transport evaluations, determinations of the impacts of shipping emissions, atmospheric deposition estimates for Lake Tahoe, etc., and the difficulty of combining the two datasets constrains our analyses. I will leave it to my colleagues to advise U.S. EPA whether the STN protocols, IMPROVE, or a hybrid should be employed by both networks. Whatever the choice, an effort should also be made to develop source speciation profiles consistent with the ambient data.

<u>Question 4:</u> Is it scientifically acceptable to generate air quality surfaces through modeled observations and/or integrated predictive/observational fields that would be of appropriate uncertainty for use in the regulatory decision-making process?

Model results are not a substitute for measurements as they rely on highly uncertain emission inventories. In general, model acceptability criteria allow much greater errors (on the order of

30% for ozone) than is acceptable for ambient air monitoring (less than 15%). I doubt the public would accept any substitute for observational data to determine non-attainment status because of the risk for "gaming" the model. Ambient air quality standards link back to monitoring data, not model results used in epidemiological studies. Could satellite data possibly be an alternative approach?

Dr. Kenneth L. Demerjian

Demerjian: December 13, 2004
Revised 12/16/04

CASAC AAMM Subcommittee Consultation on Implementation Aspects of NAAMS
December 15, 2004 Meeting at Washington, DC
Review and Comments: Kenneth L. Demerjian

The NAAMS final draft authors have incorporated the recommendations and addressed many of the issues raised by NAAMS Subcommittee of the CASAC at the July 2003 review meeting. The implementation aspects of the NAAMS, which was a subject of major concern at the July 2003 review has been addressed in the preparation of "Section 11 – Draft Implementation Plan" in the subject final draft and is the focus of discussion for this meeting. Overall the draft implementation plan is well thought out and presents a reasonable framework and process for the restructuring and reallocation of funding for level-2 and level-3 monitoring sites within the NCore conceptual plan. Unfortunately, the implementation plan still does not address the level-1 funding issue, a subject of considerable concern at the July 2003 review meeting.

The discussion around level-1 monitoring activities has gone from an "unfunded" critical element of the NCore strategy to a "possibly fundable" (via EPA's Science and Technology resources) critical element of the strategy. In a somewhat disingenuous way, the draft strategy suggests the importance of level-1 activities, but only if new S&T funds become available.

The fact is the NCore can operate without the level-1 component. The ultimate question is whether or not the incorporation of level-1 sites provides sufficient value added benefits to the NCore strategy to justify its consideration in the budgetary redistribution. The strategic plan should provide an assessment of the trade offs and limitations such choices have on NCore objectives. Blanket statements such as that made in section 12.1.2 "Resources for Level 1 measurements should not be extracted from the existing STAG resource pool, acknowledging the need for stable agency and Tribal funding support," are not supportable without a more critical assessment of the trade offs involved.

The AAMM Subcommittee was asked to focus their consultation around four major questions related to the NAAMS implementation:

1. Given limited budgetary resources, does this represent both an appropriate and adequate balance, as reflected by the relative resource allocations provided in Section 11, "Draft Implementation Plan" of the Final Draft NAAMS Document? In addition, are the relative adjustments in the training and guidance approaches proposed in the draft implementation plan consistent with the overall objectives of the Strategy?

The scenario provided in Table 11-3 indicating a proposed redistribution of Federal resources is a very good start on defining budget allocations across monitoring programs. It would be even more persuasive if the details of the FY2003 assessment performed by Regional Offices were available to determine how disparate their recommendations are from national strategy. Are these differences the consequences of conflicting priorities of the stakeholders and how do they impact the Agency's critical monitoring objectives? For reasons stated in the preamble of this critique, I believe the Table 11-3 redistribution should have included the NCore level-1 activity with an appropriate assessment of its impact (pros and cons) on the overall monitoring strategy.

This discussion should be provided in section 6.4.1 of the report and should draw upon results and findings from the Supersite programs. The level-1 discussion should also indicate the direction this specialized expertise will likely take in addressing needs and extending the vision of the national strategy. In section 12.1.2 regarding NCore level 1 resources, it is not clear that the use of STAG resources to support level-1 activities undermines the stability of state agency support. The case can be made that strong level-1 collaborative programs will have significant valued added attributes to the overall monitoring program and far out weigh any monitoring changes that might result from the budget redistribution.

There has been significant criticism of the PAMS monitoring network, specifically directed at the lack of data analysis and critical assessment of the utility of these data. I fully support the intent to divert funds a portion PAMS operational funds to support further data analysis activities, but I would suggest the EPA review its past performance as to how it has expended such data analyses funds and the overall effectiveness of those activities. Here again, the lack of easily access data dissemination has limited participation and use of these data and stifled innovations in analyses and interpretation. Any reductions in the PAMS network should be reviewed in terms of its contributions to not only its original objects (photochemical oxidant precursor), but now in light of other contributions it can make with regard to air toxics and PM_Organic precurors.

The relative adjustments in the training and guidance approaches proposed seem reasonable, but I would defer to comments from state/local entities who receive said services.

2. Does the Subcommittee have additional suggestions for addressing this need for integration and communication to the broader community of "users," including scientific researchers (*i.e.*, human health, atmospheric, ecological) and State, local and Tribal (SLT) Agency representatives? More specifically, what is the most effective manner for EPA both to reach-out to this broad user community and, where appropriate, to incorporate their feedback and design input on such issues as monitoring site locations and parameters?

Engaging the scientific research community to participate in the analysis of measurement data generated from EPA based monitoring remains a challenge. A competitive solicitation under the EPA Grants program, highlighting innovative data analysis approaches for demonstrating the utility of NCore data should be considered. Another more directed approach might consider set aside funds (e.g. STAG-105) for collaborative (State Agency /University) data analysis projects addressing specific policy relevant science questions utilizing NCore data.

It has been mentioned many times over that the key to engaging the various user communities is through effective data dissemination. The plans for enhanced data access and the evolution of the AQS remain in my mind somewhat suspect with respect to their meeting the scientific community's interests. I will reserve critical comments upon reviewing the AQS Data Mart product slated for delivery in March 2005.

3. What are the strengths and weaknesses of EPA's consideration of converting all of the Speciation Trends Network (STN) speciation sites to Interagency Monitoring of Protected Visual

Environments (IMPROVE) samplers and IMPROVE laboratory and sample handling protocols to assure consistency in sampling and analysis protocols and enhance harmonization of rural- and urban-based $PM_{2.5}$ chemical speciation networks?

Maintaining a good quality assurance program is the only way to guarantee data quality and harmonization. Diversity of samplers and methods helps to identify measurement problems and keeps the participating parties on their toes. Given that issues still remain amongst the filter based samplers and speciation measurement methods, I would view the observed differences in these techniques as beneficial and insightful in resolving measurement biases and uncertainties. At a minimum, before any action were to be considered regarding this conversion, a critical review of the collocated STN/IMPROVE results should be performed and present to the AAMM Subcommittee as well as a critical assessment of the various outstanding unresolved issues raised regarding the differences between these sampling/analysis measurement systems.

4. Is it scientifically acceptable to generate air quality surfaces through *modeled* observations and/or *integrated predictive/observational* fields that would be of appropriate uncertainty for use in the regulatory decision-making process?

There is no absolute answer to this question. It depends on a variety of factors that related to the quality and spatial representative of the observations and species specific emissions, the predictive model and GIS systems and the performance evaluation statistics for the region under study. But most importantly it begs the questions as to what is meant by "appropriate uncertainty".

Other specific comments:

p. 4-9, in Table 4-1 1st column third entry "continuous PM2.5 mass" should read "continuous mass/species"

p. 4-6, the value of monthly average NH_3 and HNO_3 is marginal and the claim it will stimulate methods R&D is questionable.

p.6-10, 1st full paragraph last sentence, " However, when measuring NOy …" the same statement can be made for the current NOx monitoring systems.

p.11-3, in Table 11-2 some comment in the notes section for IMPROVE Section 105 Grants would be informative (i.e. how are these funds distinguished from the IMPROVE Section 103 Gant funds).

p.11-5, - 1st paragraph last sentence. An example of two as to how these discretionary funds are spent by the Regional Offices would be informative.

Dr. Delbert Eatough

Initial Comments by Delbert J. Eatough on Implementation Aspects of EPA's National Ambient Air Monitoring Strategy (NAAMS)

After careful reading of the final Draft NAAMS, accompanying public comments, EPA's response to these comments in the Addendum to the Final Draft and several of the referenced material in the NAAMS, with emphasis on the Revision 2 of the Continuous Monitoring Implementation Plans, I offer the following general comments on the NAAMS, implications of expected results with respect to the successful launching of the Implementation Plan as currently outlined, and a few specific comments on the charge questions.

General Comments

Continuous Monitors: A key focus of the NAAMS is a shift from the use of integrated monitors to continuous monitors at the Level II sampling sites to be included in the NCORE Program of the NAAMS. The NAAMS document correctly points out in several sections the value of such data in providing input for use by the scientific community in the understanding of peak exposures, atmospheric processes and diurnal variations in the atmosphere. These data will all be potentially valuable to the both the SLTs and the scientific community which will also use the data. Improving public access to and developing initial interpretation of this data is a key part of the Implementation Plan. A strong push for moving in this direction is the economic advantage which can be obtained using continuous monitors, coupled with the increased understanding of atmospheric processes using the data, a potential win-win situation.

As pointed out in the NAAMS, there is also a clash between the monitoring needs of the NAAMS as outlined in the current regulations which define the fine particulate FRM as the basis of monitoring for attainment and the problems in the FRM which are addressed, but not carefully considered in the NAAMS. What will and will not be obtained using the new suite of continuous PM monitors is not considered in the NAAMS, however, the implication is there that the expected advances which might accrue form the availability of continuous data will accrue. The Continuous Monitoring Implementation Plan, on the other hand, outlined carefully the protocols which will be followed as the NAAMS Level II program is implemented. I have a great concern that the philosophy given in the Continuous Monitoring Implementation plan and the objectives for continuous monitors as outlined in the NAAMS cannot both be achieved.

The Continuous Monitoring Implementation Plan compared FRM and TEOM results across the country, and notes areas of agreement and disagreement and suggests that aerosol composition is responsible for the disagreements seen. The plan then proceeds to outline protocols intended to assure that the continuous monitors to be implemented will be consistent with data which would have been obtained with an FRM sampler. Substantial research has been reported since the Version 2 Draft of the Continuous Monitoring Implementation Plan which sheds additional light on implications of this approach.

EPA is probably correct in identifying the presence of semi-volatile material in fine

particulate matter as being related to and responsible for the agreement or lack of agreement between an FRM and a TEOM. We now understand that both nitrate and organic material can contribute substantially to the SVM. Studies which have obtained FRM and TEOM data, as well as correctly measuring both nitrate and organic SVM have shown that agreement between the FRM and TEOM monitors will occur only when either there is no SVM, or when losses of SVM is comparable for the two monitors. For example, in summer there is a tendency for both samplers to loss both nitrate and semi-volatile organic material and for there to be agreement between the two in 24-h average data. However, in winter, the FRM is often higher than the TEOM because of better retention of SVM. Moreover, on a 24-h comparison basis, there is usually good correlation in the two data sets over a given season or meteorological condition. These correlations tend to exist between the FRM and TEOM on a 24-h average even when the slope of such a comparison is different from unity. These effects probably account for some of the observed seasonal variations and generally reasonable regression comparisons in the EPA Continuous Monitoring Implementation Plan report. With such results, there is a temptation to "correct" the TEOM data so that agreement between the two systems is generally seen. While this is, potentially, an acceptable solution for monitoring purposes, serious problems are introduced with respect to the uses of continuous data as proposed by EPA in the NAAMS.

Even when there is reasonable correlation in 24-h data, comparison of 1-h average TEOM and more state-of-the art instrument (such as the FDMS TEOM) show quite a different diurnal patterns. This is because the diurnal changes in the chemistry of the atmosphere which lead to SVM not well measured by the TEOM (and often by the FRM) are averaged out on a day-to-day 24-h comparison. The events which occur leading to significant atmospheric chemistry (and potential health risk and maximum exposure conditions) occur on a frequency which can be seen in 1-h data but not the 24-h data. These events are usually missed by a TEOM. Thus, using modified TEOM data will lead to the worst possible situation, believing we have valid data on diurnal patterns because of agreement with 24-h FRM data, but completely missing the diurnal features which will to aid in the understanding of atmospheric processes of importance to exposure and possible risk. However, using an instrument which will measure SVM (and hence catch these significant events) will produce data which do not meet the agreement protocols (particularly the ±10 % slope agreement) given in the Continuous Monitoring Implementation Plan, precisely because the atmosphere is better monitored.

EPA may well be constrained to not use these newer techniques because they will not agree with the FRM and thus fail monitoring legal requirements, especially in locations where SVM is important and variable. However, a consequence is that we will be producing data which give us an inaccurate picture of the atmosphere and thus lead to incorrect decisions based on continuous monitoring data. EPA needs to find a way around this problem which can be applied to the various Level II monitoring sites, allowing for the advances in understanding which form one of the major arguments for moving toward continuous monitors. At a minimum, some (if not many) of the Level II sites should have both a FRM equivalent continuous monitor and a state-of-the art continuous monitor which allows us to better understand atmospheric processes. The comparison between the two will give valuable insights on SVM in the atmosphere and aid the health community in obtaining a better understanding of exposure.

The problem outlined in this section bears directly on Question 2 in the charge to the CASAC AAMM Subcommittee. While these issue do not address the mechanisms of communication actions, they do address the application of the NCore Level 2 network in supporting long-term health effects research and providing better support to ecosystem assessments. We may very well impede the progress we intend to assist.

Speciation Sampling. One of the most valuable uses of the speciation sampling results will be the interpretation of processes occurring in the atmosphere which lead to the observed concentrations of PM. The focus in the NAAMS Implementation is on the maintenance of 24-h speciation networks (wether STN or IMPROVE). There are two significant downsides to this approach: 1) cost savings possible with continuous speciation samplers are not realized. 2) There will be no way to use the speciation data to help us understand the atmospheric process revealed by the continuous monitor data.

EPA is correct in pointing out the current uncertainties in flash volatilization speciation results. However, new techniques have been introduced the past two years (really since the rewrite of the NAAMS, and certainly since the last version of the Continuous Monitoring Implementation Plan) which appear to overcome the shortfalls of the flash volatilization techniques. While these techniques are still in their infancy, I believe the data is there to support a reasonable introduction of the technology into the Level II sites, thus allowing the richness of the combined continuous PM and speciation results to be realized. This would be particularly true if the suggestion given above of locating both FRM consistent and state-of-the-art continuous PM instruments at a reasonable number of Level II sites were implemented. This is the only way progress will be made on moving the science forward. In fact, inclusion of these continuous monitors may be a way to fill in some of the limitations of the requirement of FRM equivalency for the continuous PM monitors. Such equivalency is not required of the speciation continuous monitors. I would hope that the level of competence of operators at the Level II sites is such that a instrument such as an ion chromatography based measurement of anions and cations would be feasible. This also opens the door to a better understanding of SV organic material.

I would consider the use of funds in this direction to be a much better direction to go than to replace all our STN sites with IMPROVE equipment which will give us constancy across the rural and urban sites (Charge Question 3) but will not really move us ahead on the use of continuous monitor PM data with respect to supporting long term health effects and atmospheric process research (Charge Question 2.)

HNO_3 and NH_3 Monitoring. Charge Question 1 includes Monitoring for these two species. However, while they are essential species to be monitoring for both PM and ozone data interpretation, and ecological effect understanding, the NAAMS Implementation Plan currently includes measuring this species only on a monthly basis. It appears to be assumed that modification of existing denuder techniques which have been extensively tested on a 24-h basis will give viable long-term average data. However, there is no data given to support this assumption. More importantly, the value of long-term averages of these two species is really not

spelled out. It is tacitly assumed the data will be valuable. I do not see how monthly-average nitric acid and ammonia data can be combined with either 24-h PM, continuous PM or continuous gaseous data to provide meaningful insights. The time frames are too different for the data to be of any value other than provided an isolated long-term average. The data may provide some insights in ecological effects but will not be useful with respect to understanding atmospheric processes.

While resources committed to this effort are admittedly small, the benefits appear to be equally small. These are new continuous monitors (ion chromatographically based, for example) which would provide this data continuously. A modest investment in evaluating these techniques could add to the justification for inclusion of such instruments in the speciation network at Level II sites (see comments above) and significantly aid both the objectives related to the Charge Question 1 And Charge Question 3.

Comments on Charge Questions 1 and 2.

As outlined above, serious problems are created when there is a mismatch between the measurements of a target species (e.g. PM) and the measurement of precursors (e.g. ammonia and nitric acid). In addition, the measurement of other precursor gases is not matched by the measurement of PM species (e.g. sulfate, nitrate) on a comparable time basis. I consider the decision to avoid continuous speciation measurement and valid continuous PM mass measurement a significant imbalance in the value of the proposed NAAMS Implementation Plan. There are options for moving ahead with a modest inclusion of continuous measurement of all pertinent species which would better reveal the usefulness of the over-all data set and provide a basis for either expanding the program to all Level II sites or reevaluating wether the Speciation Monitoring data is meeting the intended objective with respect to making informed air quality management decisions and obtaining relevant exposure data for research programs. The voids are potentially too important to ignore as a major change in direction is implemented.

Comments on Charge Question 3.

The obvious strength of the proposed shift to IMPROVE protocols for all speciation sites is that the data among all sites will be more comparable. The downside is that we are then apt to forget that there are operational definitions in the results and, hence believe, since there is consistency, there is accuracy. Perhaps the current situation of reminding ourselves, for example, that the carbon results do have problems (in both networks) is, in some ways, better. Neither the NIOSH or IMPROVE method for C analysis has been established as the superior. However, it would be useful if EPA tried to incorporate technology into the speciation network which would allow for at least an estimation of semi-volatile organic material. But then, even better yet, as outlined above, is making at least at effort toward continuous speciation at some Level II sites. This could include continuous C measurements for both nonvolatile and semi-volatile carbon based on recent developments by our group with a modified Sunset monitor. That modified monitor is now commercially available from Sunset.

Comments on Charge Question 4.

While this seems a highly desirable direction to go, as it will optimize availability of funds for important new objectives in the NAAMS, I do not have a complete understanding of how this objective would be accomplished. I also do not fully understand what is considered a suitable data base for the generation of the air quality surfaces. This may well reflect a lack of understanding of the expected process on my part, and not a deficiency in the EPA plans. I will look for further insights into this issue at the 15 December meeting. Some of the questions I have are; Will the generated fields be based on measurements of the regulated species concentrations only, or will reasonable projections of the changes in new source emissions (both primary and of precursors) closer to the modeled site be included? Will the modeled fields be generated with a suitable set of meteorological inputs to reasonable project expected transport, chemistry and deposition and variability in meteorological conditions at the modeled sites? How will the uncertainty in the modeled fields be established based on the above, and probably other points I do not see yet? If acceptable results can be demonstrated in trial locations with variability in the above, this seems like a very acceptable direction for EPA to go.

Mr. Eric Edgerton

Response to CASAC AAMM Subcommittee Charge Questions on Implementation of National Ambient Air Monitoring Strategy

Question 1: Given limited budgetary resources, does this represent both an appropriate and adequate balance, as reflected by the relative resource allocations provided in Section 11, "Draft Implementation Plan," of the Final Draft NAAMS Document? In addition, are the relative adjustments in the training and guidance approaches proposed in the draft implementation plan consistent with the overall objectives of the Strategy?

It is difficult to answer the first question without: 1) knowing the fungibility of 103 and 105 grant dollars; 2) having the criteria pollutant network assessments from the Regions; and 3) having an analysis of the PAMS network. The working assumption in Chapter 11 appears to be that PM2.5 funds (2nd largest pool) are fair game for redistribution, criteria pollutant funds (by far the largest pool) are not and PAMS funds (3rd largest pool) are somewhere in between. Given this scenario, except for the inability to fund Level 1 sites, resource allocations seem reasonable and adequate.

The PAMS network is a continuing enigma. On the one hand, it represents a tremendous investment and a game attempt to collect high time resolution data for ozone assessments. By my tally, the average operating cost for a PAMS site is nearly 375K. Many of the PAMS measurements are analogous to what is needed for PM assessment. For example, the experience of measuring 50-60 organic species by GC might come in handy when we want to measure 4-5 ions via IC. On the other hand, there is little evidence the data have ever been used or even scrutinized. My recommendation would be to conduct a forward-looking analysis of PAMS with the following questions in mind: 1) Can the network be redesigned to serve needs for ozone, PM and toxics assessments? and 2) Can a subset of PAMS sites serve as Level 1 NCORE sites? Infrastructure at PAMS sites should provide considerable leveraging. Although PAMS is not geographically positioned to provide all Level 1 sites, might it not underwrite 3 or 4, if the total number of PAMS sites were reduced to 50 or 60? If the answers to these questions is "no", then much deeper cuts in the current PAMS funding are warranted.

Regarding the second question, the QA component will need substantial funding for development of standard reference materials in addition to lab and field audits. The training component will need substantial funding to ensure the entire chain of data collection/management understands the measurement objectives. For the Level 2 sites, a key objective will be detection of secular trends, and this will require very careful attention to analyzer response in the bottom 10% of the measurement range (5-20 ppb for SO2 and NOy; 100-300 ppb for CO).

Question 2: Does the Subcommittee have additional suggestions for addressing this need for integration and communication to the broader community of "users," including scientific researchers (*i.e.*, human health, atmospheric, ecological) and State, local and Tribal (SLT) Agency representatives? More specifically, what is the most effective manner for EPA both to reach-out to this broad user community and, where appropriate, to incorporate their feedback and design input on such issues as monitoring site locations and parameters?

As a long-term solution, analysis of data for Level 1, Level 2 and PAMS sites and publication of results in peer-reviewed journals is hard to beat. It might also be worthwhile to convene symposia or panel discussions at ISEEpi (International Society of Environmental Epidemiologists, not to be confused with International Society of Explosive Engineers). There could be a panel discussion at annual SLT monitoring workshops. The panel would include recognized experts in the relevant fields and would discuss future monitoring needs and opportunities. In the near-term, all data users should be alerted to the NCORE Strategy and impending changes, and encouraged to provide feedback.

Question 3: What are strengths and weaknesses of converting all of the Speciation Trends Network (STN) speciation sites to Interagency Monitoring of Protected Visual Environments (IMPROVE) samplers and IMPROVE laboratory and sample handling protocols?

Harmonization is seductive; however, I would recommend a thorough analysis of network protocols before making a wholesale move to IMPROVE. Clearly, something needs to be done about carbon and a switch to the IMPROVE protocol (TOR) makes sense in terms of current operational definitions of OC/EC. Not so clear is whether STN measurement technologies and sample handling protocols should be replaced. Does either network offer advantages in flow control or Dp_{50} or sample preservation? For various reasons, IMPROVE does not measure ammonium ion, an important component of $PM_{2.5}$ mass, a nutrient species and an important counter-ion to nitrate and sulfate. Instead, IMPROVE incorrectly assumes that nitrate is always associated with ammonium and that sulfate is always fully neutralized by ammonium (molar ratio = 2). We have to do better than this if we are ever going to understand dynamics of particle formation, etc. STN, on the other hand, does measure ammonium and does have protocols in place to ensure a certain level of data quality. If a change is in the cards, it will be important to ensure it doesn't impair current data quality.

Question 4: Is it scientifically acceptable to generate air quality surfaces through *modeled* observations and/or *integrated predictive/observational* fields that would be of appropriate uncertainty for use in the regulatory decision-making process?

From a scientific standpoint, you want to bring all information to bear. The key will be in understanding uncertainties and properly factoring them into the decision-making process. If this can be done, then there are significant advantages to the concept, including better definition of attainment/non-attainment areas and potentially accelerated designation/re-designation. While

the scientific advantages are obvious, using combined surfaces for regulatory decision-making may be a very tough sell to stakeholders.

Eric S. Edgerton
12/19/04
Cary, NC 27513

Mr. Henry (Dirk) Felton

Responses: Dirk Felton, NYSDEC (Submitted 12/14/04)
Charge to the CASAC AAMM Subcommittee
Dec 15th 2004 Meeting

General Comments follow the four questions to the committee:

1. The CASAC has expressed its support for the Agency's proposal to redesign the routine PM monitoring network to support PM precursor gas measurements (CO, SO_2, NO/NOy, NH_3, HNO_3) at NCore Level II multiple-pollutant sites, and for air quality management decisions and to obtain relevant exposure data for research programs.

Questions: Given limited budgetary resources, does this represent both an appropriate and adequate balance, as reflected by the relative resource allocations provided in Section 11, "Draft Implementation Plan," of the Final Draft NAAMS Document? In addition, are the relative adjustments in the training and guidance approaches proposed in the draft implementation plan consistent with the overall objectives of the Strategy?

> No, the proposed extensive PM-2.5 non-attainment areas demonstrate that PM monitoring and particularly PM-2.5 speciation cannot be reduced in many areas. Additionally, it may be that the PM-2.5 annual and daily NAAQS will be lowered which could require additional monitoring resources. This was evidenced after the implementation of the 8-Hr Ozone NAAQS. More borderline attainment areas required additional monitors and non-attainment areas required additional up and downwind monitors. Establishing sites is difficult and expensive and it does not make sense to close a site that may be needed a short time later for ozone, enhanced PM-2.5 or PM-coarse monitoring. Many of the NCore principles are important and should be gradually incorporated into the existing NAMS and SLAMS requirements.
>
> The training and guidance approaches may be consistent with the strategy, however, it is not generally helpful for the monitoring agency staff who need it most. Many of the staff who will be operating the newer technologies are located in remote offices without the ability to travel or to access many of these information resources.

2. The implementation plan proposes a series of communication actions to advance the NCore Level 2 network, in order to more directly support long-term health effects research and provide better support to ecosystem assessments through an increased level of coordination.

Questions: Does the Subcommittee have additional suggestions for addressing this need for integration and communication to the broader community of "users," including scientific researchers (*i.e.*, human health, atmospheric, ecological) and State, local and Tribal (SLT) Agency representatives? More specifically, what is the most effective manner for EPA both to reach-out to this broad user community and, where appropriate, to incorporate their feedback and design input on such issues as monitoring site locations and parameters?

State agencies that have non-attainment concerns must be able to select site locations based on how they believe they will be able to demonstrate the effectiveness of their SIP. This monitoring, which is already aimed at protecting human health must take priority over other research monitoring priorities. Health oriented researchers may be interested in urban hotspot monitoring while a modeler may be interested in a boundary site or even a monitoring location chosen at random. The monitoring objectives and operational procedures may be too different for some of these groups to reconcile in one monitoring location or in a comparable dataset.

State and Local Agencies face the very difficult task of operating quality-assured monitoring networks consistently for long periods of time. Many research oriented monitoring programs are designed to examine a particular issue and then publish results. Some of these Science oriented monitoring programs such as CASTNET have demonstrated problems in the long term operation of criteria instrumentation. One CASTNET site in the lower Hudson Valley expanded to Ozone monitoring. Over time, the operation of the instrument was not properly quality assured and the Regional EPA office attempted to make the surrounding area non-attainment for ozone because of this data.

It is advantageous for the various monitoring agency, health agency and research groups to meet regularly to discuss instrument selection and limitations, data comparability, multi-media pollutants public awareness and other issues.

3. One of the remaining technical issues relates to harmonizing rural- and urban-based $PM_{2.5}$ chemical speciation networks such that both categories of networks utilize consistent sampling and analysis protocols. For example, EPA is considering converting all of the Speciation Trends Network (STN) speciation sites to Interagency Monitoring of Protected Visual Environments (IMPROVE) samplers and IMPROVE laboratory and sample handling protocols.

Question: What are strengths and weaknesses of this approach?

The urban IMPROVE study has not been completed and it is not apparent that the IMPROVE protocols would be entirely successful in urban environments. For example, inlets on IMPROVE sampler are cleaned annually while the STN inlets are cleaned either Monthly or after each sample depending on the type of sampler. A better approach would be to select the strengths of each network and design a new Nation-wide program. Carbon sampling techniques can be drastically improved by minor changes in flow rates, filter shipping containers and field procedures. Since the cost of analysis is so high for this program, it makes sense to optimize the sampling equipment in an effort to raise the quality of the data.

4. As EPA implements the National Ambient Air Monitoring Strategy to address multiple monitoring objectives, it will be looking to spatially *optimize* the ambient monitoring networks. This may mean that some redundant monitors in adjacent, but separate, geopolitical areas (*e.g.*, neighboring counties) are "divested" from a given network. Although technically sound, these divestments could result in data gaps which might, in turn, adversely impact regulatory decision

making. The Agency is willing to adopt alternative approaches for assessing regulatory issues such as non-attainment designations, so long as such approaches are scientifically justifiable; hence, the rationale for initiating discussion of these issues with the CASAC.

Question: Is it scientifically acceptable to generate air quality surfaces through *modeled* observations and/or *integrated predictive/observational* fields that would be of appropriate uncertainty for use in the regulatory decision-making process?

> No, ambient data must be used in the regulatory decision making process. This is clear from all of the recent cases where ambient data has been used to refute poor model performance. Models are developed to work in a majority of usually simplified applications. It is difficult enough to verify a model's overall predictive accuracy but impossible to prove that it accurately covers all areas of a domain. Many areas of a State or Territory may not fit into the acceptable range of a model and this could not be known without actual data. Recent experiences have shown that the EPA is willing to use models that are not accurate or verifiable.
>
> For example, the EPA's accepted model for use in PM-10 SIP development calculates road dust concentration based on the mass emitted from vehicle tailpipes. This model was developed for older cars on roads with fewer vehicles than those of today. The model substantially over-predicts the amount of vehicle generated PM-10 in dense urban areas such as NYC. What is disappointing is the EPA's lack of concern or attention to poor model performance even when it prevents State Agencies from meeting their requirements.
>
> Another example is the EPA's use of the Urban Excess model which has been inappropriately applied in the urban Northeast. The EPA is currently using this model to determine the extent of the PM-2.5 non-attainment areas. This model has been applied without taking into account actual ambient data, transport, secondary particle formation, meteorology or differences among monitoring programs.

General Comments on the National Air Monitoring Strategy:

The majority of people on the AAMM board work in the research field and most likely will be in favor of the overall NCore strategy. Many of the NCore objectives are worthwhile such as trace gas monitoring, a greater emphasis on data and program analysis and a better integration with health and multimedia communities. There is more disagreement towards the overall objectives of NCore from State and Local monitoring Agencies and perhaps even from the Regional EPA offices. I see a greater loss from what is left out of NCore than what may be gained from its adoption in its present form. I think the lack of enthusiastic support from some of the EPA regional offices stems from their concern that when the spatial coverage of monitoring is reduced, they will have a more difficult time responding to public issues and complaints.

My concerns with NCore include the melding of networks with different design principles such as PM-2.5, Ozone and Toxics, the lack of emphasis on sources, characterization, controls and

permits and the reduction in State Agency flexibility due to the tightening of SPM (Special Purpose Monitor) regulation. The NCore funding strategy was determined by examining Nation-wide statistics from AQS Criteria Data. The value of individual State networks or even individual sites cannot be examined in this way. What is the value of a PM-10 instrument if it is the only one downwind of a permitted facility? What will happen when the PM-10 standard is rescinded before suitable PMc stack testing methods are developed. Data from many State and Local Agency's monitoring sites are put into the AQS system even though these sites are not Federally-supported SLAMs or NAMs monitors. In NY, for instance, almost one third of the Ozone monitoring network operates at State funded Acid Rain sites. Closing these sites would not create the funding opportunity that the NCore strategy indicates.

Many of the positive attributes of NCore can be implemented with less disruption to State and Local agencies' existing monitoring and permit programs. Currently, State and Local monitoring programs are evaluated by their respective EPA Regional offices annually. This network review should be expanded to include representatives from the National OAQPS office, health officials and if the case warrants; scientific specialties, such as atmospheric modelers, deposition researchers, the Forest Service, the Park Service, NOAA, etc. The NCore monitoring objectives, sampling technologies and operational experience should be available as a resource to the stakeholders at these network design meetings.

Other goals of NCore may be achieved or at least improved upon through simple procedural changes. Some State Agencies still upload ½ of their MDL (Minimum Detection Limit) to AQS in place of their concentrations for parameters such as NO_2 and toxics. This convention prohibits modelers, risk assessors and data analysts from using low concentration data in their analysis. Other low cost opportunities to improve low concentration data include lowering span concentrations where appropriate, setting up dual range analog outputs, and through the use of digital data logging.

The benefit to the State and Local monitoring agencies from the implementation of NCore is supposed to be the flexibility that results from the reduction in criteria monitoring. The NCore strategy suggests that 1000 may be an appropriate number of NCore Level III sites operating Nationally. When this number is examined as representing the majority of the spatial component of monitoring including PM-2.5, PM-10, PMc, Lead, Ozone, NO2 and Toxics, it is apparent that there will not be any "surplus" Level III sites available for State and Local Agency specific needs. The resources needed to establish monitoring for SIP development, control strategy verification, toxics hot spot investigations or investigations of environmental justice are not clearly defined in the Air Monitoring Strategy Document.

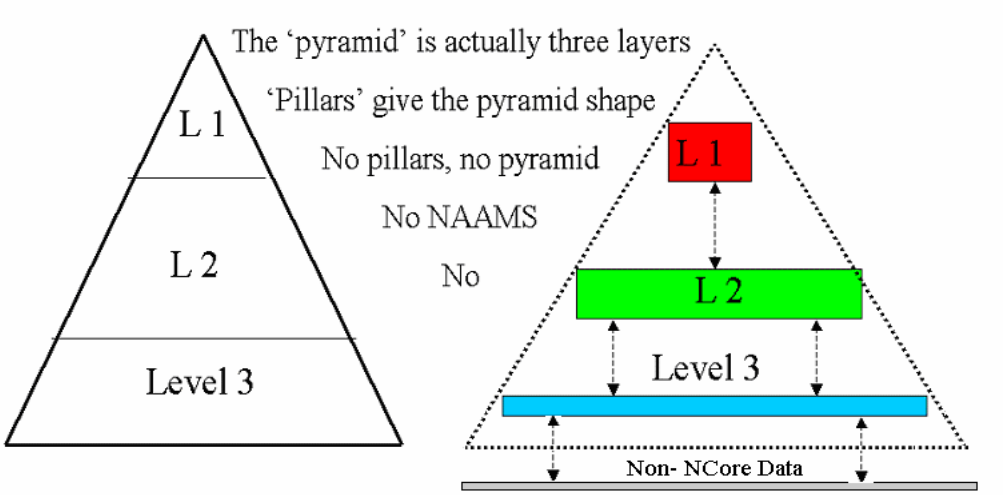
Dr. Rudolf Husar

Response to the NAAMS Implementation Plan

Rudolf Husar, CASAC AAMM Meeting, Updated December 17, 2004

Overall, the NAAMS implementation plan is as good as its parent conceptual plan. It has been developed through the same responsive participatory ***process*** and it shows. The freshness of the implementation plan sounds almost too good. What's the ketch? Actual Implementation?

Question 0: Is the plan consistent with the NAAMS strategy?
To a large degree yes. A key implementation issue concerns the realization of the multi-tier, monitoring strategy represented by the 3-level pyramid. Implicit in the strategy is that the levels will be mutually supportive entities for the characterization of air quality. How will the tiers be linked to form a coherent monitoring unit that provides useful, integrated data from the new integrated network?



Question 4: Is it scientifically acceptable to extrapolate observations by physical or statistical models?
Not only acceptable, but a necessity for integrating the multi-tier data. Thus, spatial data extrapolation (say from L2 to L3 and below) should be an integral part of NAAMS strategy implementation. It should be part of the monitoring process. 'Smart' extrapolation schemes can now be used to constrain the estimates by the data as well as by physical laws. The derived pollution 'surfaces' resulting from the monitoring process could then be used for regulatory as well as for many other purposes.

Question 1: Is this implementation plan an appropriate reallocation of monitoring resources?
The bulk of the reallocation makes sense. However, routine network assessment and level 2-3 data integration need specific implementation plan and line item in the budget. The $$ for these

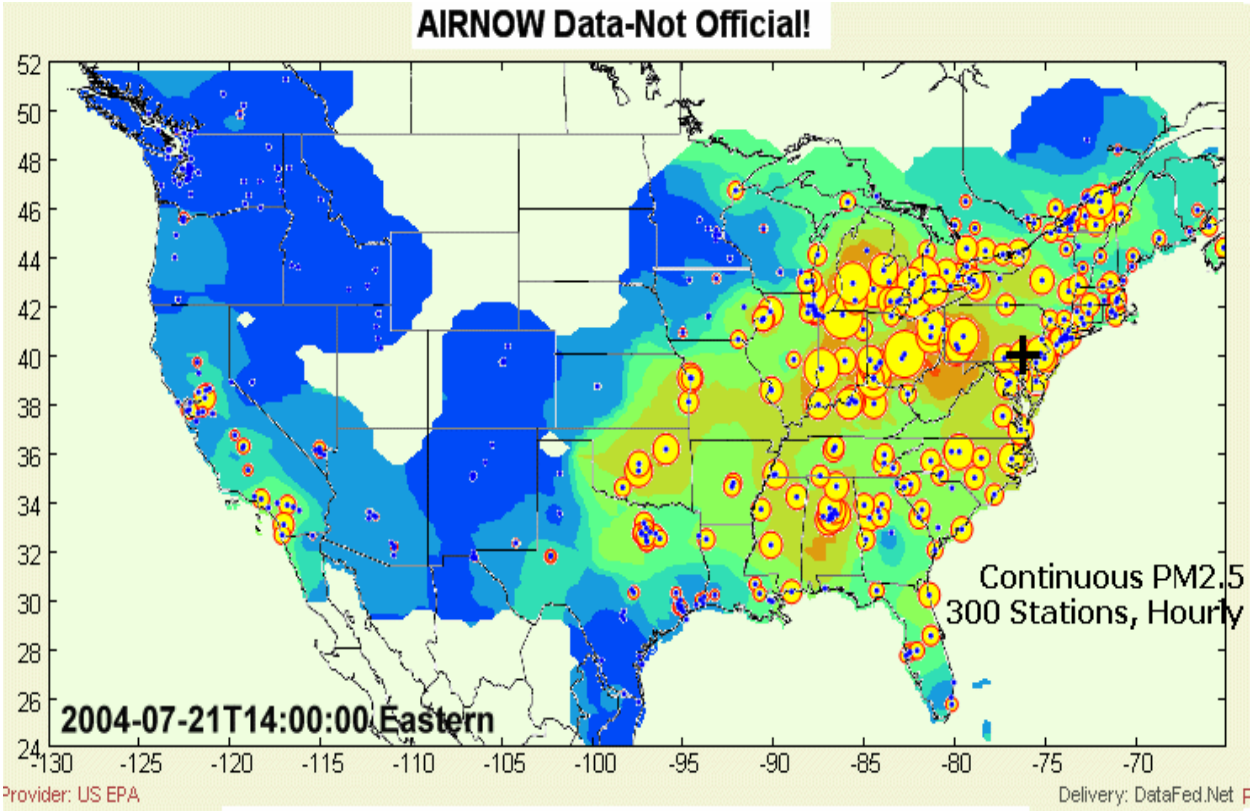
network operation activities could be from reduced PAMS and from the dubious $10M PMc monitoring allocation.

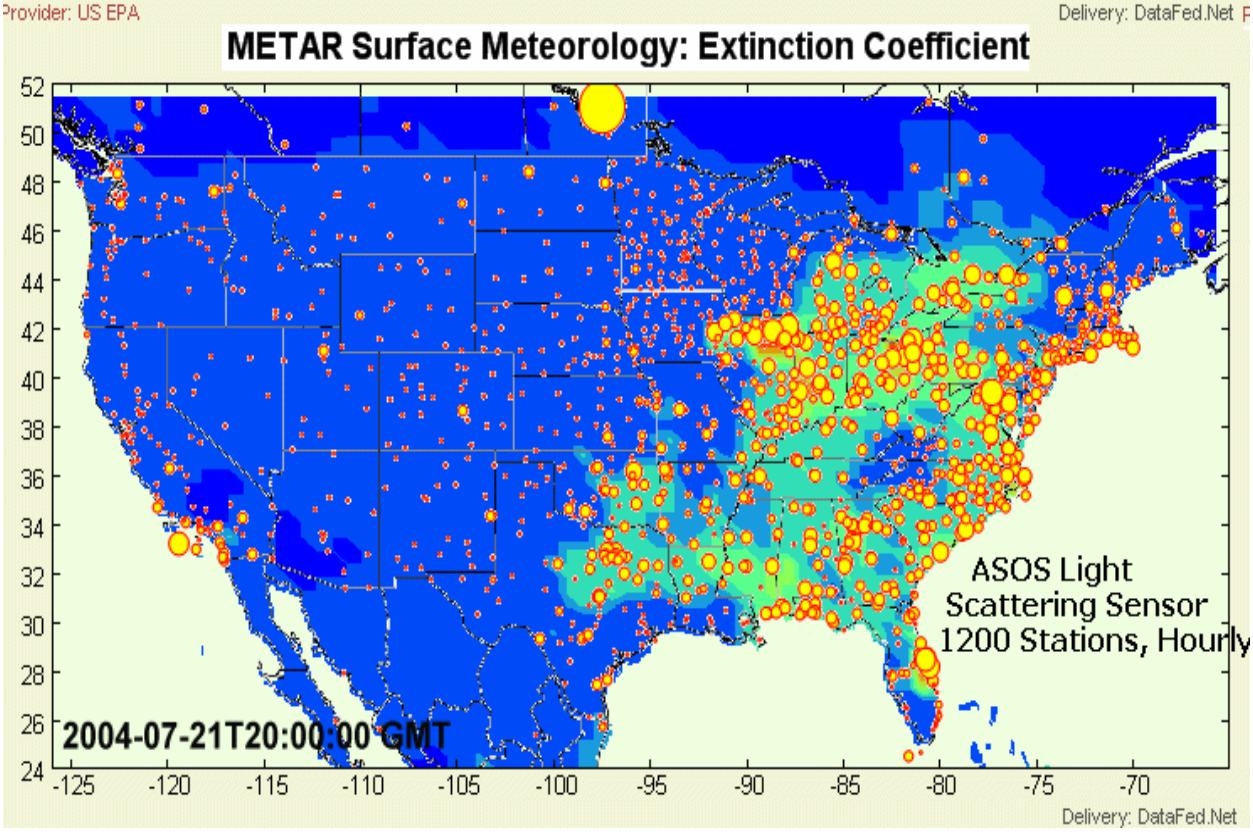
Question 2: How to improve communication with user communities (health, atmospheric, ecological)

By a more open NAAMS process (glasnost) and by closing communication feedback loops.

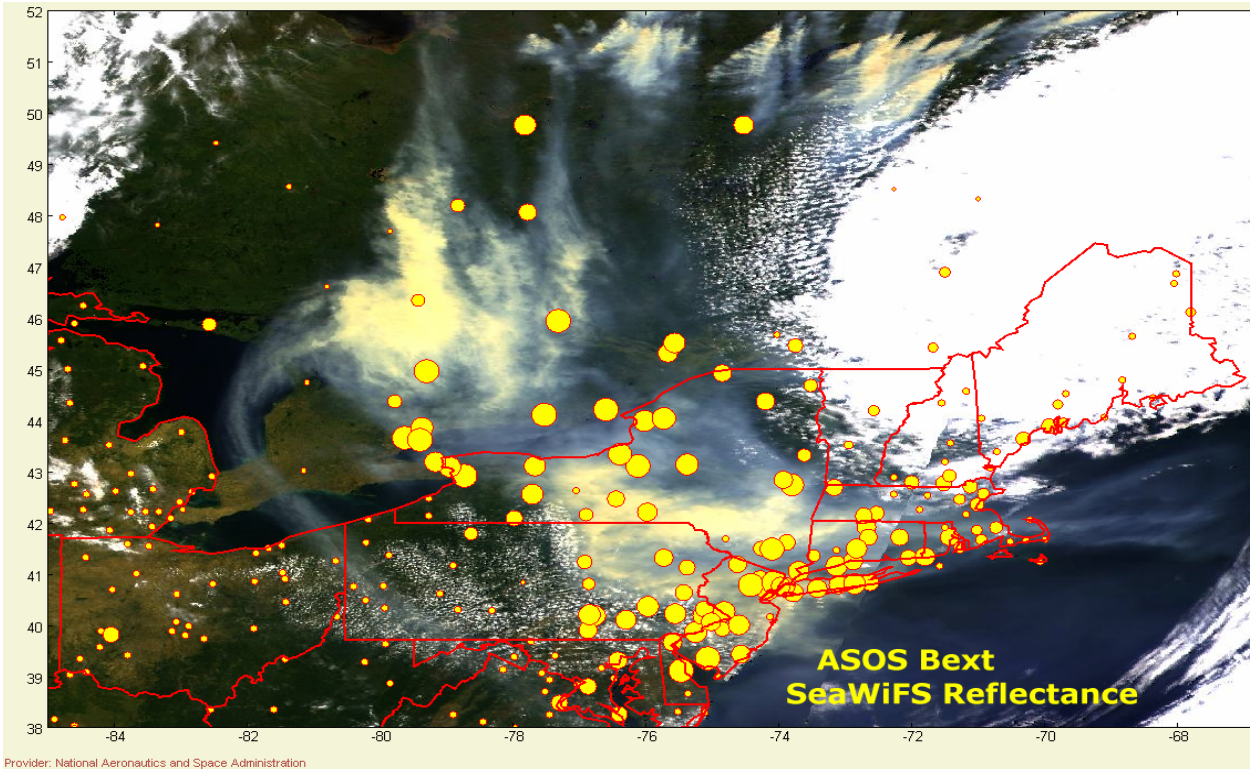
Question 3: Should the STN sites be converted to the IMPROVE protocol? IF (Since) the STN approach does not show distinct advantages, it would make sense to adopt the IMPROVE protocol for all routine speciated monitoring, so urban-rural differences can be reliably quantified.

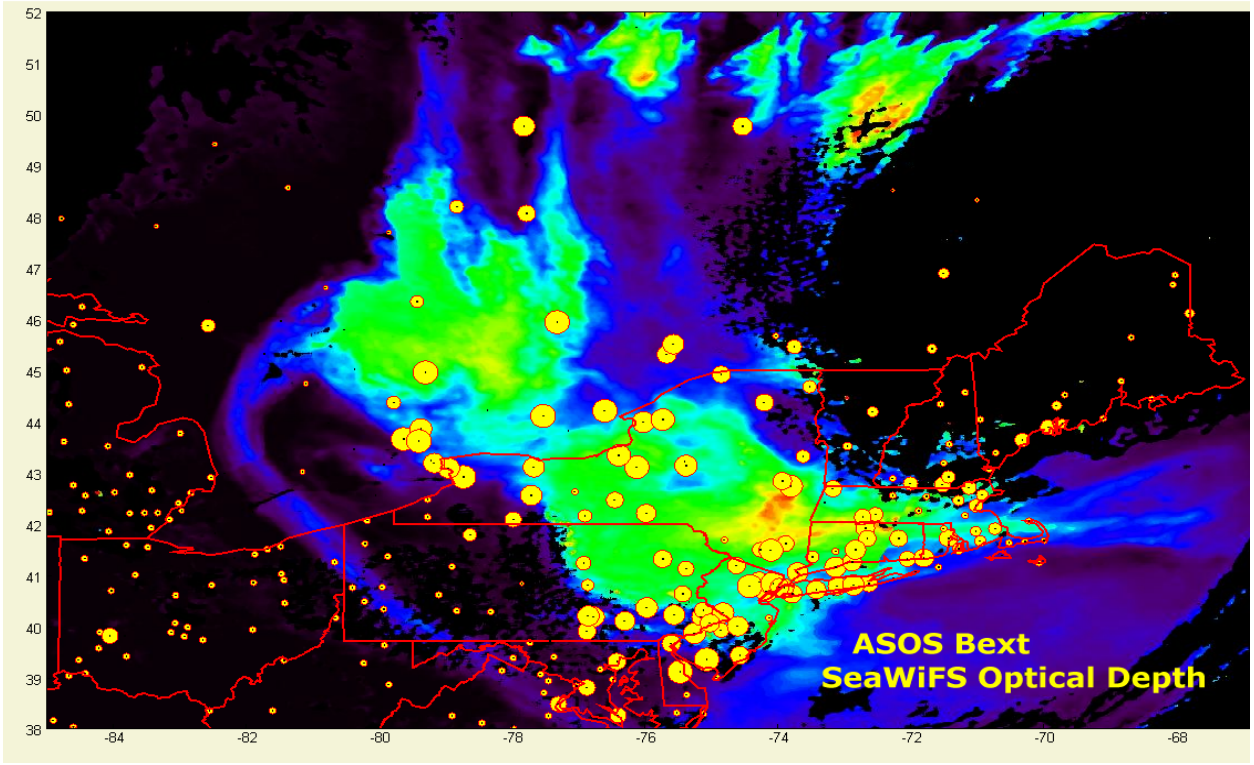
The implementation plan takes a very defensive posture toward linking with non-NCore networks. There are several readily available real-time datasets that could significantly augment the NCore aerosol characterization, e.g. ASOS and Satellites. As shown below, the spatial coverage of real-time AIRNOW PM25 (~300 stations) and ASOS light scattering networks (1200 stations) operated by NWS, FAA and DoD would enrich the spatial texture AND the *in situ characterization*


AIRNOW Data-Not Official!
Continuous PM2.5
300 Stations, Hourly
2004-07-21T14:00:00 Eastern
Provider: US EPA
Delivery: DataFed.Net


METAR Surface Meteorology: Extinction Coefficient
ASOS Light
Scattering Sensor
1200 Stations, Hourly
2004-07-21T20:00:00 GMT
Delivery: DataFed.Net

Satellites add spatial texture (MODIS, 250m), source identification (smoke, dust) and some vertical information. The example shows a superposition of ASOS Bext and 1 km resolution SeaWiFS reflectance and Aerosol Optical Thickness during the July 2002 Quebec Smoke event. The augmenting the NCore 3-tier pyramid with such data should be encouraged and made explicit in the implementation plan.


ASOS Bext
SeaWiFS Reflectance
Provider: National Aeronautics and Space Administration


ASOS Bext
SeaWiFS Optical Depth

Dr. Kazuhiko Ito

Revised comments on the NAAMS final draft.

Kaz Ito, 12/20/04

General comments:

I came into this review process rather late (this Final Draft was the first draft I read regarding NAAMS). Since most of the decisions regarding the network design have been already made, some of my comments may be too late. I will nevertheless provide these comments hoping that they may still be useful in the remaining period of implementation as well as in the future revision of the Strategy.

The difficulty of balancing the budget with the most reasonable scientific decisions to re-design the ambient monitoring network is overwhelming, but I was impressed with the level of effort and progress made so far. The proposed NCore network is appealing. Its plan to collect multi-pollutant data at each monitor accommodates the need of health effects research community (such data were often lacking in the past network monitors). I understand that the priorities of the state and local agencies are the most important factors in designing the new network, but I also hope that the Strategy will take a closer look at the issues and the needs of the health effects research community. In the past ten years, many observational epidemiological studies utilized the data from these routine monitors, producing valuable inputs into the process of setting the NAAQS. It is interesting to note that, while the main motivation to reduce the number of monitors for CO, SO_2, and NO_2 comes from the observation that most of these monitors measure levels well below the NAAQS, many of the PM studies in the past ten years reported associations with mortality and morbidity at levels well below the NAAQS. I am not implying that I am against reducing redundant monitors (I am all for it). I am just suggesting that we should do this carefully. I assume that determining the "redundancy" for CO, SO_2, and NO_2 monitors would be much more complicated than for more regional pollutants such as O_3. Also, it seems that the decisions about the speciation monitors are being made without detailed analyses of the new speciation network data (collected so far, 2001-2004). Some specific comments related to these issues are given below.

Question 1: Given limited budgetary resources, does this represent both an appropriate and adequate balance, as reflected by the relative resource allocations provided in Section 11, "Draft Implementation Plan," of the Final Draft NAAMS Document? In addition, are the relative adjustments in the training and guidance approaches proposed in the draft implementation plan consistent with the overall objectives of the Strategy?

It is not easy for me to assess the adequacy of the balance without knowing the details of the process to eliminate a certain fraction of monitors (for example, what reasoning was used to reduce non-trend $PM_{2.5}$ speciation sites from 160 to 80?). Given my limited knowledge on this process, the general distribution of budget seems ok to me.

Question 2: Does the Subcommittee have additional suggestions for addressing this need for integration and communication to the broader community of "users," including scientific researchers (*i.e.*, human health, atmospheric, ecological) and State, local and Tribal (SLT) Agency representatives? More specifically, what is the most effective manner for EPA both to reach-out to this broad user community and, where appropriate, to incorporate their feedback and design input on such issues as monitoring site locations and parameters?

The Strategy should obtain feedback from the epidemiology/public health researchers who have been using the data from these routine monitors as well as those who have been involved in setting up their own monitors for epidemiological studies. I do understand that the existing and future air monitoring network is not necessarily for epidemiological studies but mostly for regulatory and compliance purposes, and the budget and capacity of the SLT agencies would determine the type and extent of the change in the network design. However, input from the health effects research community should still be useful, especially because so many of the observational epidemiological studies relied on the use of data from these routine air monitors that were not developed for epidemiological study designs. Monitor site location needs for both short- and long-term health effects study designs should be considered. I speculate that many of the epidemiologists and public health scientists who have used the routine air quality network data are unaware of the changes that are taking place through the Strategy. I would suggest a workshop to identify and discuss the issues among the health effects/exposure community. Federal Register is certainly not the medium that these researchers regularly seek information from. At the NAAMS subcommittee meeting, Dr. Scheffe suggested that Health Effects Institute may be a good place to have such a forum, but I think we need to reach a broader list of researchers who should be informed on this issue. I know that some of us are even writing grant applications (without knowing the changes in the network design) that rely on these air quality data. Aside from getting feedback, at minimum, all the current and recent EPA grantees, as well as those who have been involved in this type of research should be notified of the proposed changes.

Question 3: What are strengths and weaknesses of converting all of the Speciation Trends Network (STN) speciation sites to Interagency Monitoring of Protected Visual Environments (IMPROVE) samplers and IMPROVE laboratory and sample handling protocols?

I think it would be easier to answer this question if we had a good summary of the STN data that have been collected so far (2000-2004) so that we could compare various aspects of the data with those for the IMPROVE database. The IMPROVE web site has a very good descriptive analysis of their data. I haven't seen a similar analysis for the STN (I am sure many of us, including myself, are trying to do this now). So, it is somewhat frustrating to make a judgment without sufficient knowledge. With this limitation in mind, the strength of switching to IMPROVE protocol would be that we would have one larger database that is measured in a consistent way. At the 12/14/04 NAAMM meeting, I learned that they are collecting data using co-located monitors with the STN and IMPROVE protocols. We should probably wait for these data to be analyzed before we make decisions.

Question 4: Is it scientifically acceptable to generate air quality surfaces through *modeled* observations and/or *integrated predictive/observational* fields that would be of appropriate uncertainty for use in the regulatory decision-making process?

This question is rather general. However, for a specific situation, I think there is always a "scientifically acceptable" (the best available, anyway) way to use the modeled data. I assume that EPA is referring to the surface depiction of some smoothed data such as Figure 5-1 on page 5-1 of the NAAMS final draft. In this case, the objective appears to be to identify areas where removing existing monitors does not affect the predictive power of some statistics, in this case, the 4th highest 8-hr daily maximum average O_3 value. The approach taken for the objective here seems reasonable. The remaining question would be the model uncertainty associated with the interpolation methods. For example, if we used another available method (e.g., kriging) to estimate the surface, how much difference does it make? Also, how do you decide on the acceptable (tolerance?) level of error?

At the 12/14/04 NAAMM meeting, I learned that these modeled surfaces were not being used for determining monitoring "redundancy" to remove monitors, so I take back my initial concern about the application of these models for SO_2 and NO_2 monitors. I maintain my concern regarding the applicability of these models for non-regional pollutants. For regional pollutants (e.g., O_3 and sulfate), we can generally assume smoothness in spatial variability (except high density traffic areas where NO may quench O_3). Determining concentration surfaces for $PM_{2.5}$ monitors may also be relatively less problematic in areas where spatially homogeneous secondary sulfate dominates $PM_{2.5}$. Estimating concentration surfaces for CO, SO_2, and NO_2 as well as some of the $PM_{2.5}$ species would be more difficult because they are more strongly influenced by primary emissions from local sources, and the monitor-to-monitor correlations are much poorer both in terms of temporal correlation and mean levels. The problem with the locally impacted pollutants that, if separation distance of two monitors is relatively far (> 20 miles), then the two monitors having similar average concentrations (or any annual statistics) does not necessarily imply that a point between the two monitors would have a similar concentration because they may simply reflect separate local sources that do not reach or influence concentrations at the mid-point. Thus, the prediction error would be greater for these pollutants than O_3 or $PM_{2.5}$ in many of urban areas. I looked at monitor-to-monitor temporal correlation for PM_{10} and the gaseous pollutants in the nationwide data, and found that the overall rankings in monitor-to-monitor correlation within the same Air Quality Control Region to be: O_3, NO_2, and PM_{10}, ($r \sim 0.6$ to 0.8) > CO ($r < 0.6$) > SO_2 ($r < 0.5$), confirming the larger prediction errors for locally impacted pollutants. We will have to deal with this issue for the $PM_{2.5}$ speciation data. Some of the $PM_{2.5}$ species are more locally impacted than others. The implication is that differential errors across the $PM_{2.5}$ species from different source types (e.g., regional vs. local pollution sources) will affect source apportionment results and associated prediction errors. This issue needs to be investigated using the current trend and non-trend $PM_{2.5}$ speciation monitors' data. Ideally, such information should influence the decision as to which non-trend monitors should (can) be removed (for the planned reduction of non-trend monitors).

Dr. Donna Kenski

Response to CASAC AAMM Subcommittee Charge Questions on Implementation of National Ambient Air Monitoring Strategy

Donna Kenski
Lake Michigan Air Directors Consortium
December 14, 2004

Question 1: Are the relative resource allocations appropriate and balanced?

The allocations presented in Table 11-3 seem mostly reasonable. However, the continuing inability to confirm a funding mechanism for Level 1 sites is disturbing. These are an integral part of the strategy and must be allotted adequate long-term funding. It is greatly encouraging to see a line item for data analysis (two line items, in fact). The data analysis funding for the toxics program has been a terrific investment that has and will continue to yield benefits for years to come. That said, the strategy's funds for data analysis and interpretation seem a bit puny for the size of the program – even the least generous estimates suggest that a minimum of 10% of project funds should be spent on data analysis. Although some analysis will be undertaken by SLTs or others, the costs are considerable to plan, perform, and integrate various analyses and then make the results web-accessible. Inadequate funding will only leave us with unanswered questions and broken or unsatisfactory public access to important data.

While the decrease in gravimetric PM measurements is justified, and moving to continuous PM is advisable, the document doesn't discuss allocations to continuous speciation measurements, except the modest bump-up in CASTNET funds for their 3 pilot sites. These continuous speciation measurements are ultimately the most revealing about the nature of PM2.5, and more investment on EPA's part is absolutely critical. These measurements are perhaps best left to the Level 1 sites for now, but EPA needs a stronger commitment (financial and political) to advancing the state of science of these measurements so that they can eventually be rolled out to more sites. Since ORD isn't supporting this development, perhaps the strategy could take a stronger stand.

Training and guidance adjustments were consistent with objectives; the emphasis on webcasts and DVDs should be well received by states. It's nice of EPA to acknowledge the travel restrictions that so many SLTs are subject to. I'm a little skeptical that these types of training can really be adequate for some of the more complicated measurements – e.g., NOy. In general, while the strategy's objectives were clear, I have some doubts that the existing technology (and the states' willingness to operate it) are really ready for this broad dissemination. Here again, as the strategy notes, EPA/ORD has failed to keep up with the needs of the monitoring community, leaving a very large gap between our measurement needs and the technology available (commercial or research) to meet those needs.

Question 2: How can EPA best reach the user community and incorporate their feedback?

Well...why not just ask them? EPA knows the user community. It's not that complicated or expensive to put together a list of people likely to have something to say on these issues. Put

together a short, focused set of questions, or even a draft proposal that gives EPA's rationale for site selection, then get on the phone or email. You are much more likely to get meaningful responses if you ask people directly. And don't forget to ask the stakeholders, too.

Question 3: What are the strengths and weaknesses of converting STN to IMPROVE?

From a data analysis standpoint, harmonizing these networks would be a huge improvement. The urban/rural signals we're so anxious to tease apart are hopelessly obscured by these network protocol differences. But so many issues are yet to be resolved! Blank correction – to do or not to do? What's the right way? What role do inorganics and the various organic species play? What's the effect of higher mass loadings on samplers designed for clean rural environments? Is there a 'machine' effect at DRI or RTI – do different instruments yield different results for the same protocol? This is not my area of expertise, but since both IMPROVE and STN protocols are just that, and the EC/OC measurements are operationally defined, it seems silly to have the two major networks be incompatible. We should choose one and be consistent. Even though there are many outstanding questions (some of which should be answered by Supersite data and other current studies), IMPROVE's very long and very reliable record make it the obvious choice. EPA should make this switch part of the strategy, and get a plan for the transition in place ASAP.

Question 4: Is it scientifically acceptable to generate air quality surfaces through modeled observations or integrated predictive/observational fields that would be of appropriate uncertainty for use in the regulatory decision-making process?

Of course it is scientifically acceptable to generate surfaces from modeled or observed data. Defining 'appropriate uncertainty' is more difficult. Our interpolations should be based on a fundamental knowledge of spatial variability of a given pollutant. In some cases we have a very good understanding of pollutant emissions, dispersion, transport, and the resulting spatial variability. But there are serious gaps in our knowledge of other pollutants. We don't have any good idea of NH3 or HNO3 spatial variability across an urban area, so how can we have a realistic estimate of modeled uncertainty for such pollutants? And if our modeled PM2.5 estimates depend on these precursor concentrations, then this uncertainty will propagate through a model and perhaps lead to unacceptable uncertainty for decision making. This lack of data on spatial variability (particularly on a microscale or in complex terrain) is a data gap that the strategy doesn't really address. There really ought to be some provision for determining spatial variability via short term saturation monitoring.

Dr. Thomas Lumley

Comments on the National Ambient Air Monitoring Strategy.

Thomas Lumley
Associate Professor of Biostatistics
University of Washington.

General comments:
The EPA has proposed removing monitors that are statistically redundant, moving towards continuous-time monitoring of major pollutants, improving data accessibility, and setting aside specific funds for data analysis. These are all excellent ideas if they can be achieved. My understanding is that there is some disagreement about the accuracy of continuous-time PM mass measurement, which may reduce the usefulness of the continuous-time data. There may still be benefits in automated telemetry of even 24-hours average data.

Spatial variability:
While the general use of monitors that are representative of broad population exposure is to be encouraged, there is a need to characterize some small-scale spatial features.

The epidemiologic evidence supporting the current PM standards is based largely on studies of acute effects of exposure. These typically compare changes over time in PM concentrations to changes over time in the rate of adverse health events.
For these studies it is important only that the temporal pattern of concentrations at the monitors tracks the temporal pattern of population average exposure. It is thus sufficient that a monitor be broadly representative of a population area.

More recently, there has been increasing interest in studies of the effects of longer-term exposure. These studies examine how differences between people in exposure are related to differences in risk. For these studies it is important that the variation in exposure between individuals is well estimated. These studies require much more accurate information about spatial variability. While much of the detailed monitoring required for large epidemiologic studies can appropriately be carried out by study personnel, it would be useful to have some information about common spatial features. In particular, the spatial pattern of pollutant concentrations near major roads in both rural and urban areas is of interest. Current monitoring provides good data on CO in urban street canyons, but relatively little information on PM gradients near roads.

Data analysis and availability
Improved ease of access to air quality data would be a valuable outcome of a new strategy. Providing complex data in a form that can be readily used is difficult, however. The iHAPSS website produced at Johns Hopkins and funded by the Health Effects Institute (http://www.ihapss.jhsph.edu) is an impressive model, but required substantial

resources and is targeted to one specific use of the data. It may be useful for some data analysis resources to be made available specifically to support collaboration in data analysis between EPA and non-EPA researchers.

The experience of the NHLBI-funded Cardiovascular Health Study (CHS) may be relevant here. As required by NIH, CHS has made large quantities of data publically available and even provided a part-time staff position to handle any enquiries about the use of the data. Very little use has been made of these public data. On the other hand, many researchers with no prior connection to CHS have found a CHS sponsor and made productive use of the data in that way.

Charge questions

1. I cannot comment on whether the resource allocations would be sufficient for the given tasks. Assuming that they are sufficient, the balance appears reasonable and consistent with the objectives of the Strategy

2. The Agency and other Federal bodies already require grant-funded researchers to make certain data publically available. The Agency should consider also encouraging researching to share data analysis tools they develop, where this can be done without undue effort or confidentiality problems. In addition to lowering the barriers for researchers new to the data this would improve the transparency of research.

   Some Agency recognition for successful and creative use of routine monitoring data in public communication (eg good web displays) might increase awareness of the value of EPA data.

3. The strength of a uniform IMPROVE protocol is that measurements will be more comparable across space. One obvious disadvantage is that they will be less comparable over time. For epidemiologic research this is of secondary importance as the main within-location comparisons that are of interest are short term. I note that the greater uniformity need not imply greater accuracy — as far as I know it is not clear which measurements of, eg, carbon fractions, are the most accurate.

4. It is in principle scientifically acceptable to generate air quality surfaces by empirical fitting or mechanistic modeling that would be of satisfactory quality for regulatory decision making. The current decision making procedure already aims to protect public health over a relatively large spatial region from measurements at a few points. In deciding which monitors to remove from a network it would be useful to consider how close the air quality is to regulatory limits, both now and in the near future. For a given level of redundancy of information it would be more desirable to remove a monitor that was far below a regulatory limit than

one very close to the limit. In addition, as noted above, retaining a small number of geographically close monitors would be useful to investigate small-scale spatial gradients.

Dr. Peter McMurry

Peter H. McMurry
University of Minnesota
December 18, 2004

Comments on EPA's plan for Implementing the National Ambient Air Monitoring Strategy

General Comments:

a. I compliment the EPA Staff who developed this strategy. They have been responsive to previous recommendations by this committee, and have taken the initiative to create a coherent vision that extends well beyond specific recommendations of the committee. NAAMS represents a clear vision for a measurement strategy that is suitable for the 21st Century. NAAMS will lead to more efficient use of the Agency's resources for carrying out measurements and providing access to data. This strategy will play an important role in protecting the public's health and welfare. It has been a pleasure to serve on this committee.

b. *My primary concern with the NAAMS proposal is the lack of a plan for funding Level I sites*. My arguments in support of Level I sites are listed below:

- I have been involved in studies of atmospheric aerosols for more than 30 years. During this period, the need for instrumentation that would measure, in real time, the composition of aerosol particles was clearly understood. With funding from the EPA Supersites program (and other programs that focused on airborne particles) in the 1990s, several different instruments were developed to enable such measurements. This is terrific progress. However, while several such systems are now commercially available, the technologies have not yet grown to maturity. Level I sites would enable continued testing of such instrumentation. I have no doubt that within the next decade, instruments that can routinely and automatic measure the composition of atmospheric aerosols will be available. Level I sites will play an enormous role in ensuring that this occurs.

- State and local agencies prefer to use instruments that operate continuously rather than filter samplers, which are more expensive to operate and provide less useful data. Level I sites will provide platforms for evaluating the performance of such instruments.

- Real-time measurements of composition offer the potential to provide much more useful information on aerosol composition and at a much lower cost than can be achieved with filter samplers. Real-time data is required to evaluate chemical transport models, to assess human exposures, and to understand processes that affect size-resolved aerosol composition. I am convinced that such data are needed to significantly advance our understanding of the effects of atmospheric aerosols (especially their health effects). Level I sites would play a substantial role in advancing measurement technology "to the next level."

• Virtually all of the basic research and development on real-time instrumentation for measuring the composition of atmospheric aerosols has been carried out in the U.S. Level I sites will help to enable this industry sector to grow to world leadership.

• The measurements that are proposed for Level II and III sites do not include any measurements of ultrafine particles (<100 nm) despite the fact that (1) concern has been expressed about possible health effects of sub-100 nm particles, (2) planned changes in emissions control (especially for diesel-powered vehicles) are likely to lead to significant changes in concentrations of ultrafine particles, and (3) recent work has shown that such particles can be measured well on a routine basis. Such measurements have been conducted for extended periods (more than a decade, in several cases) in other countries, and these long-term measurements are providing extremely valuable information on trends and "climatology." Again, this is a case where the basic R&D was carried out in the U.S., but the benefits of that work are largely being realized abroad.

• One of the greatest scientific challenges is understanding semi-volatile species (i.e., species that are present in both gas and particle phases). Important among these are ammonium nitrate, and many organic compounds. We cannot currently measure all semi-volatile compounds on a routine basis (although techniques for measuring the gas and particle phases or inorganics in real time are available.) Organics are an especially challenging problem. Level I sites would enable continued work on this problem, which is likely to play a significant role in potential health impacts of air pollutants, and which will require more work before gas/particle distributions can be accurately represented in chemical transport models.

c. Based on the discussion at our meeting I concluded that realizing the full benefits of NAAMS will be hampered by EPA's organizational structure. As was pointed out by Professors Husar and Hopke, it is important that NAAMS data (1) be available in real time, and (2) be easily accessed by the public. The presentation by representatives in the Information Transfer and Program Implementation Division made it clear that they do not currently plan to establish a data access strategy that meets these needs. It appears that the Monitoring and Quality Assurance Group is hampered because the Information Transfer and Program Implementation Division is not responsive to their needs. This needs to be changed.

d. Recent studies provide growing evidence that those who live immediately downwind of highways are especially likely to experience adverse health effects from air pollutants. The NAAMS strategy does not explicitly deal with this issue. Some consideration should be given to citing some of the NAAMS sampling stations in locations that would enable long-term studies of such effects.

e. I served as one of three co-chairs on the NARSTO PM Assessment, and I wrote Chapter 11 of that Assessment, which addressed needs for further research. I am delighted to note that many of NARSTO's recommendations are included in the NAAMS program. NARSTO recommendations that are not explicitly discussed include:

• The NAAMS proposal makes no mention of any consultations or discussions with monitoring agencies in Mexico or Canada. One of the NARSTO recommendations is that networks across North America should be "harmonized" to enable the integration of

knowledge from ambient measurements, receptor models, chemical transport models as bases for air quality management. I recognize that the U.S. cannot dictate to Canada and Mexico how they should carry out air quality measurements. However, if they were informed about U.S. plans, they would have an opportunity to work in parallel to develop measurement programs that are reasonably compatible.

• NARSTO recommends that we aim to develop methods to assess benefits of emission controls to air quality and the linkage to human health and welfare. NAAMS focuses primarily on measurement, without explicit consideration given to the use that will be given to such data.

• NARSTO recommends that ASOS and AWOS data be integrated into national air quality monitoring programs. Such data are acquired routinely, but not by EPA. The public would benefit substantially if such data were included in NAAMS.

My responses to questions given by Richard Scheffe in his November 19 memorandum are given below:

Q1. Given limited budgetary resources, does this represent both an appropriate and adequate balance, as reflected by the relative resource allocations provided in Section 11?

My primary concern is the lack of a specific plan to fund Level I sites, as explained above. Other committee members have expressed other concerns that should be reviewed by EPA.

Q2. Does the Subcommittee have additional suggestions for addressing the need for integration and communication to the broader community of "users."

Meet with Mexicans and Canadians to inform them of our plans, in hopes that they would establish compatible measurement strategies and data distribution policies.

Q3. What are the strengths and weaknesses of converting STN to IMPROVE.

I will defer to others on the committee who are more knowledgeable than I about sampling and analysis strategies for these networks.

Q4. Is it appropriate for EPA to use "models" for identifying non-attainment areas.

First, it is important to clarify what is meant by a "model." Is this a full-blown chemical transport model (CTM) that includes everything that is known about meteorology, sources, transport and transformations of air pollutants? If so, than it would be appropriate that such models be used for regulatory purposes. CTMs would also provide useful information on diurnal variations, etc., which is typically not obtained from sampling networks used for attainment studies. Of course, different models will produce different results, so the choice of models that are used for this purpose would be highly controversial.

More empirical models that interpolate among data from sparse measurements would need to be used with greater care. Such an approach would probably work reasonably well for species that are distributed relatively uniformly. However, when species are emitted locally, then such interpolations would likely lead to significant errors.

So, in summary, the use of "models" is needed, but implementing them for regulatory purposes will not be straightforward.

Dr. Armistead (Ted) Russell

Review of EPA's Final Draft National Ambient Air Monitoring Strategy and responses to Charge Questions

Armistead (Ted) Russell
Georgia Institute of Technology
Atlanta, GA 30332-0512

Having read through the new Draft Implementation Plan section of the Final Draft National Ambient Air Monitoring Strategy in detail, followed by the whole report, as well as attending the AAMM meeting and presentations by EPA, my first comment is that I was pleased to note the extent to which the strategy has evolved since our last review, and how they have addressed many of the comments provided in the last round. In particular, they have increased their focus on monitoring to address issues dealing with environmental endpoints, e.g., health and ecosystem impacts. As noted below, there are lingering issues in this regard. Also, I note that they are planning on adding more sensitive CO monitors: another plus. There is also increased emphasis on analysis.

In this review, first, the four questions we have been charged are addressed. This is followed by a more global discussion and summary.

Question 1. Given the limited budgetary resources, does this (the redesign) represent both an appropriate and adequate balance? Are the adjustments in the training and guidance approaches consistent?

As noted above, I am pleased to see that more sensitive CO measurements will be pursued as part of the NCore Level II monitoring as this is important both for understanding of PM sources, but also as a marker for the potential presence of elevated concentrations of other automotive emission related species. In our recent source apportionment work, we found that having SO2, NO/NOy and CO measurements available led to more stable and reliable results when conducting PM source apportionment. The gas phase species act to constrain the solution space. Further, these measurements can be made at a temporally finer scale than is currently being used for the PM speciation.

In the preamble to this charge, the emphasis was on gas phase measurements. In regards to PM measurements, the reduced emphasis (and resource allocation) on FRM PM mass measurements is applauded as they help relatively little with understanding the sources and solutions of the PM in a region. Continuous measurements help somewhat. However, it was not apparent if the continuous measurements are primarily mass or speciated mass measurements. Continuous mass measurements still fall short of providing the type of information needed to really understand the sources impacting a region and for evaluating source apportionment study results. Greater emphasis on semi-continuous speciated measurements by the emerging techniques is suggested. Even if this does not cover the full range of species needed to conduct CMB-type source apportionment, they will support other approaches, plus provide more

information on the atmospheric dynamics. Further, along with the continuous gas-phase measurements, one can utilize additional methods for assessing source impacts. Thus, if the increased emphasis on continuous methods does not include continuous (or semi-continuous) speciated measurements, I would rethink the resource allocation to include this important set of measurements, at least in a limited, critical area, approach. This will also lead to identifying the appropriate technologies to use elsewhere.

I would, in fact, go a bit further, and suggest that resources for non-continuous, speciated measurements be reduced and those put in to continuous speciated measurements. One could still, at a very reduced frequency, still conduct a full suite of speciated, integrated (filter-based) measurements for use with CMB-type analyses, and also seasonal detailed OC analysis. I would suggest that this source apportionment, along with the continuous gas and PM speciated measurements will provide ample information to understand, even better, the sources impacting a receptor, and provide much more information to those who might use the data later (e.g., the health community).

The adjustment in training and guidance seems reasonable, though I do not have a good feel for the level of resources it takes to effectively address this task.

Question 2: Does the Subcommittee have additional suggestions for addressing this need (communication and coordination with health effects and ecosystem assessment communities), including scientific and SLT representatives? What is the most effective manner for EPA to reach-out, obtain and incorporate feedback?

Again, EPA is to be applauded for recognizing this need. However, the document was rather vague in how this would be accomplished. I would be more proactive, identifying which cities have been the basis for many of the recent health studies, as well as the researchers. Ask them, specifically, what they would recommend. (A possible workgroup?) Likewise for ecosystem researchers. Also, EPA should address the issue of site representativeness again. The Supersite data, and that for other special studies and routine monitoring provides a wealth of data to address the questions: How representative is a single site being used for health/ecosystem assessments? What determines the representativeness of a site? How should one identify a site that is a balance between having an historical record and is most representative of the exposures (human/ecosystem) of concern? The issue of site representativeness for use in different purposes has not been well addressed, particularly with attention to uncertainties. This is explored further in the response to Charge 4.

Question 3: What are the strengths and weaknesses of this (harmonizing rural and urban-based PM2.5 chemical speciation networks, e.g., using the IMPROVE EC/OC method) approach?

There is no easy answer here. In general, there are a variety of benefits to using consistent methods, which usually outweigh some minor reasons for maintaining different approaches for different applications. Data analysis is typically much more straightforward with less uncertainties (note the word uncertainties, not uncertainty… one deals with the number of uncertainties, the other with the total amount of uncertainty introduced) when the measurements are conducted in a consistent fashion. On the other hand, there is some value in having two (or

more) competing approaches in terms of more readily identifying weaknesses in the other approaches, and if there is a known weakness in the approach that is to be adopted. In the case of the IMPROVE vs. NIOSH method debate, both have weaknesses. My read is that the case is very much open as to which one has greater weaknesses, in particular the consistency of results for conducting source tests and the ensuing source apportionments. It would be a mistake to adopt one method now if it makes if introduces a greater uncertainty in the analysis of the measurements, e.g., if the diesel pm profile is more consistent using one method over the other. Thus, it may be premature to switch right now. I have heard that the argument for choosing IMPROVE over NIOSH is that IMPROVE has been around longer, and is not willing to change. This is the wrong reason to switch the STN approach. EPA should show, and the community agree, that IMPROVE has fundamental advantages over NIOSH. Without this, we should not switch as that will close, possibly very adversely for future analyses, an important debate. If one can develop better source profiles using NIOSH, then NIOSH should be used and vice versa. Again, this is an area where the measurement community at large should discuss which method, ultimately, is preferred and for what reasons. Absent from this debate should be that one method or the other has been around for longer. That should come second.

In summary, I support harmonization of the methods used, but as an evolution to using the best techniques, not as a convenience.

Question 4: Is it scientifically acceptable to generate air quality surfaces through modeled observations and/or integrated predictive/observational fields that would be of appropriate uncertainty for use in the regulatory decision making process?

Great <u>set</u> of issues arising from this one question! First, however, I would not use "modeled" observations in this process. Use simulated concentrations. That will upset fewer people.

Next, should one use purely simulated concentrations? Surely not with today's level of modeling accuracy/reliability. That was an easy answer. However, one could also answer is that any worse than relying on a single observation in determining attainment/non-attainment and to identify sources viewed as contributing to PM in a region. The measurements are representative of a very limited region. This gets back to Question/Charge 2. While an observation showing non-attainment very, very strongly suggests that the PM levels in a region are out of attainment with the standards, it is less strong for determining attainment! The degree to which the observation is below the standard is suggestive as to how confident one is that the region is fully in attainment, but it has a limited spatial application to demonstrating that the region is in attainment. A number of observations in a single region does provide further evidence to determining attainment, but the observations all have limited spatial application and further analysis is necessary to support their regional representativeness.

Thus, this leads to the use of integrated predictive/observational fields as being the preferred approach. While there is much work to be done here, this approach will help tackle multiple issues. First, it is probably the best way to extend an observation (or set of observations) both spatially and temporally, if necessary. Second, it can be used in the process of source apportionment (or vice-versa-: source apportionment can be used in extending the use of observations). Third, it will help identify uncertainties in the representativeness of the

observations at a monitoring location. Fourth, it will produce the type of information that can be used by groups identified in Question 2. Thus, this is, in some ways, the silver bullet. However, we still do not have the best approach laid out, and the enabling technologies developed (e.g., software/hardware environments to provide this information). However, this can probably be tackled within three or for years. Such a process should utilize the observations available, both *in situ* and remote (e.g., satellite) and PM modeling (with data assimilation). There should be a feed-back loop where the information provided by the integrated system utilizes additional approaches to assess the quality of the fields developed (e.g., data withholding, etc.). While this may seem lofty, but EPA should set, as a goal, to have a field of source apportioned daily/monthly/yearly PM for the U.S. by 2010 (e.g., target PM2.5 and coarse for 2008, with the apportioned fields developed by 2010). The work should also include fields of the uncertainties in the integrated daily PM levels and, at least, in the annual source apportionments. This should be updated on an on-going basis. (Once it is done once, the second time is relatively easy.) If the resources were currently available, I suspect this could actually be achieved by 2008 (using 2006 data).

I like what was presented at the meeting in this regard. EPA is going the right direction, i.e., by developing surfaces using an integration of observations and modeling. They must take it one step further, and that is to also calculate uncertainties. Folks who are against using modeled concentrations for attainment/non-attainment decisions must realize that at present, we are not even being so sophisticated. A number of counties are designated non-attainment without even such information, and some are being designated non-attainment even with observations suggesting attainment. Let's put some more rigor in the process, then struggle with the issue of whether one should be 95% confident that a county is in/out of attainment to make determinations.

General Discussion. As noted in previous discussion, I am generally pleased with the Draft Implementation Plan and their responsiveness to prior recommendations. I am concerned about the motivation to move to the IMPROVE approach without further discussion about the disadvantages and advantages of the variety of methods. Given that I strongly recommend going to more semi-continuous speciated measurements, this may be somewhat moot… instead of discussing IMPROVE vs. NIOSH, lets discuss how to do the measurements semi-continuously (if that is at all feasible), and the NIOSH vs. IMPROVE attributes as part of that discussion. Given that the reason for conducting speciated measurements is to do source apportionment, the question to address is which one is best suited to that task. This requires asking (and answering) the question which method will provide the most consistent source profiles within a source category and is least sensitive to interferences from atmospheric processing. (Difficult question… ask the real experts.)

We were not directly charged with addressing the reduction in the funding for PAMS and the allocation of resources directly for analysis of PAMS observations. PAMS data has been plagued by both issues of quality and timeliness, and has been badly underutilized. To this end, I would devote greater resources to the analysis of PAMS data, at the expense of other aspect of PAMS, possibly reducing the coverage (spatially and temporally) of the PAMS network until we milk the current PAMS data and understand what the network can really tell us. This will help identify the future role of PAMS, and how resources should be allocated down the road. Until

we really start using the PAMS data for what it was intended, let's spend some additional resources to do more analysis of what we have with the concurrent reduction in resources allocated for producing more unused data from monitoring.

Question 4 is a very important question in regards to policy and the need to develop the appropriate techniques to achieve EPA's objectives in a scientifically defensible fashion. With satellite observations, a much more powerful information technology infrastructure and new, but not "reference method" measurement technologies coming on line, there is the possibility of being able to estimate air pollutant fields, exposures, and source impacts, much better than can be achieved from individual monitoring sites. This includes better identification of "exceedences" defined more broadly as not specifically measured, but sufficiently likely given the full range of information available. (Determining sufficiently likely will be fun.) Use of the full range of sources can reduce the needed resources for pure monitoring, but this requires developing the foundation that can undergo scientific and legal scrutiny. This activity will also provide a foundation for better forecasting and control decisions. Don't be shy about tackling the set of problems associated with blending observations (of whatever type), model results, and other inputs.

Finally, the NCore Level 1 sites should get funds from sources other than Science and Technology as part of the mission of these sites is regulatory, and their operation should not be viewed as something that has little relevance to today's issues. Planning requires knowledge of sources, which can come from NCore level 1 sites, as will attainment/non-attainment decisions. Using the process EPA has developed to decide high-priority Level 2 sites, one could also locate high-priority Level 1 sites, which then would be used, along with more detailed modeling, to identify the regional sources.

Dr. Jay Turner

CASAC AAMM Evaluation of Coarse Particle Monitoring Methods
Comments Submitted by Jay Turner on December 23, 2004
As Follow-Up to the December 15, 2004 Meeting

Per the November 19, 2004 memorandum from R.D. Scheffe to F. Butterfield, the Subcommittee has been charged with three questions: "(1) given limited budgetary resources, does this [the proposed network redesign] represent both an appropriate and adequate balance, as reflected by the relative resource allocations provided in [...]"; (2) Does the Subcommittee have additional suggestions for addressing this need [communication actions in the implementation plan] [...]"; (3) What the strengths and weaknesses of his approach [converting all STN speciation sites to IMPROVE samplers and IMPROVE laboratory and sample handling protocols; and (4) Is it scientifically acceptable to generate air quality surfaces through modeled observations and/or integrated predictive/observational field that would be of appropriate uncertainty for use in the regulatory decision-making process? My written comments focus primarily on the background materials provided prior to the meeting with some additional content added in response to the meeting deliberations.

Question #1. Given limited budgetary resources, does this [the proposed network redesign] represent both an appropriate and adequate balance, as reflected by the relative resource allocations provided in [...]"? I do not have the background to frame a response in terms of the adequacy of relative resource allocations. However, the following comments are offered purely from the measurement (not resource) context. Overall, the approach appears sound...

Regarding the upgrade to trace gas measurements, in 2001 or 2002 Warren White conducted an analysis of criteria gas data at the Jefferson Street (Atlanta, GA) site and the 13th and Tudor (East St. Louis, IL) site; it was striking how much added knowledge could be gained from the trace gas monitors compared to the conventional monitors. I encourage you to contact Warren for these materials if EPA is interested in assembling a concrete example of the added value in deploying trace measurements.

I echo the comments of several Subcommittee members that the lack of programmed funds for Level I sites is disheartening. Both the Supersites program – and some current activities which were catalyzed by the Supersites program – demonstrate the intrinsic value of having a few such sites. For example, while our measurement matrix at the St. Louis – Midwest Supersite is scaled back significantly from the core measurement period (April 2001 – May 2003), we have sustained out role in providing a platform for vendors to beta-test instrumentation both in terms of collocated measurement data and on-site field personnel. A key element of this role is the extensive engagement of our site personnel with the instrument developers, accomplished in large part because this is an explicit part of our mission.

Current instruments for semi-continuous PM speciation (sulfate, nitrate, OCEC) do not have adequate challenge tests for determining field performance. There was discussion at the meeting regarding feasibility of inlet challenge tests for such instruments. Regardless

of such feasibility, it will be imperative to have routine (at least monthly) filter samples collected at such sites with *rapid turnaround* on the chemical analysis (mass, ions, OCEC) as this data is needed as part of the *routine* instrument performance check.

The Final Draft of the National Ambient Monitoring Strategy states that detailed site assessments will be conducted. I strongly support this effort as this metadata is critical for the data users. Historically, network expansions to add additional measurements (in contrast to new sites towards increasing measurement density) often capitalize on existing infrastructure. However, the zone of representation for a site is necessarily pollutant dependent and, depending on the measurement objective, what might be a "good" PM speciation site might not be a "good" NATTS site. Detailed metadata is needed to provide adequate context for interpreting site-specific data. As nationwide data becomes more-readily accessible, it is very important for the user to also have readily-accessible access to important metadata (including narratives of the site characteristics, aerial photographs of the sites, digital imagery, …).

Question #2. Does the Subcommittee have additional suggestions for addressing this need [communication actions in the implementation plan] […]"? I have no concrete suggestions to offer in this area. Certainly coordination with HEI would be prudent. I understand they have funded someone to look at the STN network with a critical eye towards its potential use in exposure and health effects studies (proposals were due in Spring 2004). This activity might shed light in a consolidated manner on what existing sites / siting characteristics would be desirable. As for getting out the message to possible end users about the network redesign (and specifically, network pruning), in addition to the stakeholders discussed at the meeting, perhaps another channel is the respective metropolitan planning organizations (MPOs). They are often charged with addressing the cross-section between air quality and transportation planning, and thus often have air quality advisory boards with broad representation.

Question #3. What the strengths and weaknesses of his approach [converting all STN speciation sites to IMPROVE samplers and IMPROVE laboratory and sample handling protocols? From my perspective, the only glaring weakness is that we will be breaking a time series of up to five years in some locations. Considering the advantages, however, and especially in light of most of the intended data uses, this may indeed be justified.

Both networks have strengths and limitations, and currently the differences between the protocols make it very difficult to integrate the data sets. I do not advocate a hybrid approach which attempts to take the best elements from both STN and IMPROVE; even if politically palatable, it would break the time series for *two* large networks. On the other had, there certainly may be aspects of the STN program that work towards providing a 'better" representation of the true aerosol; it would be very important to document such differences even if the "better" process is not adopted. An example includes cold shipping and handling of all substrates - does it really make a difference, in light of actual sampling conditions and post-sampling field latency? Such questions will not necessarily be answered – at least not directly – through STN/IMPROVE intercomparisons but it would be very fruitful to conduct small studies to address such

issues (or simply summarize, in the context of background for the network transition, the data that has already been collected on such matters).

Finally, as discussed at the meeting, IMPROVE integrates not just the sampling and analytical work, but also the quality assurance. If the transition from STN to IMPROVE is indeed implemented, this could be an opportune time to refine the QA strategy for the urban network and thereby ensure both its integrity as well as direct comparability to the rural network.

Question #4. Is it scientifically acceptable to generate air quality surfaces through modeled observations and/or integrated predictive/observational field that would be of appropriate uncertainty for use in the regulatory decision-making process? My response is a qualified "yes". Approaches such as model-generated air quality surfaces with "nudging" by observed data could have substantial use, subject to the caveat that we have adequate input data, fully understand the key physicochemical mechanisms that are built into the model, and have an adequately dense monitoring network. A very good example – based strictly on air quality surfaces of observed concentration fields – is particulate matter nitrate in the Midwest and Central Plains. Recent expansion of the IMPROVE network by adding several protocol sites to the CENRAP domain has dramatically changed the shape of air quality surfaces for PM nitrate and surfaces generated prior to the network expansion would have been misleading. While this is stating the obvious, it hopefully reinforces the high bar that must be set.

Dr. Warren H. White

Initial responses to the AAMM charge Warren H. White, 12/8/04

<u>Question 1:</u> Given limited budgetary resources, does this represent both an appropriate and adequate balance, as reflected by the relative resource allocations …?

I think it serves as a *model* for how to extract maximum utility from given resources. It is a thoughtful initiative that has been carefully deliberated, and is well crafted to align the Agency's air monitoring activities with the needs of the coming years.

<u>Question 2:</u> Does the Subcommittee have additional suggestions for … communication to the broader community of "users," including scientific researchers (*i.e.*, human health, atmospheric, ecological) … to incorporate their feedback and design input on such issues as monitoring site locations and parameters?

The Agency is already doing very well in this regard, but I might suggest adding measurement *quality* to the list of issues on which inputs are explicitly solicited. I have in mind here such uses as epidemiology, where critical information is carried by *variations* in concentration rather than by concentration itself, or source apportionment, where it may be carried by small shifts in concentration ratios, or by inter-species correlations. The real data needs of such uses can be tricky to express in terms of the accuracy and precision of individual measurements. Of course, every researcher you ask will just say "more is better!" And you will have to disappoint them. What you learn by asking, though, is what *kind* of "more" they want; which aspects of measurement quality are critical in their contemplated applications.

<u>Question 3:</u> EPA is considering converting all of the STN speciation sites to IMPROVE samplers and IMPROVE laboratory and sample handling protocols. What are strengths and weaknesses of this approach?

"If you want an exact answer, make just one measurement." That's the strength *and* weakness of this approach. The core problem is that particulate matter has so many degrees of freedom. EPA can simply *define* one particular measurement as truth, as it did in the $PM_{2.5}$ FRM, but this doesn't mean that important information won't later be found in the rejected alternatives, as the existence of the speciation samplers acknowledges.

Any benefit of preserving dual networks would come from understanding their differences, and that would require extensive overlap (collocated sampling), laboratory experimentation, and data analysis. You have to sort out how often-subtle differences in sampling and analysis interact in practice with the varieties of aerosols actually found in different environments. And this has to be a sustained effort, if you are interested in trends over time; materials and practices inevitably evolve through the years, and the differences can be expected to compound. I think there are better uses for the Agency's limited resources. And absent the considerable resources to do it right, running dual networks will yield nothing but problems; you will always be wondering whether your differences arise in the atmosphere or the measurements.

So I think the strengths of moving soon to the IMPROVE model substantially outweigh the weaknesses. With that bottom line, here are some thoughts on specific strengths and weaknesses.

Strengths of IMPROVE sampler: converting would clearly bring more consistency to sampling, not just between the networks but also *within* STN. Moreover, the IMPROVE sampler is field-proven and operator-friendly.

Weakness of IMPROVE sampler: it employs a critical orifice rather than active flow control. While flows are measured accurately, they are allowed to depart from the nominal rate that yields a 2.5 μm cut-point in aerodynamic particle diameter. Average cut-points lie outside the 2-3 μm range in about 1 of 10 samples.

Strengths of IMPROVE protocols: there is no good reason for maintaining two non-comparable systems for analyzing and reporting carbon measurements when both use the same basic principle, thermal analysis. DRI (the carbon laboratory used by IMPROVE) has invested a lot of research into the underlying method, and I trust their fundamental understanding of it.

Point of clarification: Would "*all* of the STN speciation sites" include those oriented to SIPs rather than trends? If it includes SIP sites, what sort of data quality objectives does the Agency have for such trace XRF elements as Lanthanum, Yttrium, Cerium, Samarium, Niobium, Europium, Terbium, Hafnium, Tantalum, Gallium, Indium, Tungsten, Iridium, Scandium, Antimony, Gold, Cesium, Mercury, and Barium, all of which are currently reported by STN* but not by IMPROVE? That is, how will it specify data quality for elements that are rarely/barely detectable?

* Standard Operating Procedures for PM2.5 XRF Analysis, Revision 2, 1/20/2004.

Question 4: Is it scientifically acceptable to generate air quality surfaces through *modeled* observations and/or *integrated predictive/observational* fields that would be of appropriate uncertainty for use in the regulatory decision-making process?

Given that both satisfy the relevant data quality objectives, I don't see any scientifically meaningful difference between modeled and measured data. I can't believe I said that!

Dr. Yousheng Zeng

December 15, 2004 AAMM Subcommittee Advisory Meeting
Comments on the EPA NAAMS Implementation Plan

By Yousheng Zeng (AAMM Subcommittee Member)

Initial comments: December 14, 2004
Revised: December 20, 2004

Response to Charge Question 1:

Based on the NCore Level 2 parameter list in Table 4-1, if these PM precursor gas measurements are not required for NCore Level 2 sites, it will leave only $PM_{2.5}$, $PM_{2.5}$ speciation, PMc, and ozone. This will almost downgrade Level 2 to Level 3. Considering the usefulness of these measurements co-located with other Level 2 instruments and only 75 Level 2 sites nationally, I certainly consider it appropriate to include these gaseous PM precursors at Level 2 sites. This seems barely adequate, if at all.

By comparing Table 4-1 and Table 4-3, there seem to be some mismatch. Table 4-1 does not include air toxic measurements as core parameters for Level 2 sites. However, according to Table 4-3, air toxic trends are one of the objectives for Level 2 sites. How can air toxic trends be assessed through Level 2 monitor network if air toxics are not measured at Level 2 sites? How the measurements for air toxic trends be implemented?

Response to Charge Question 2:

My comment for this question is about presentation for communication purposes. I feel that the representation of the big picture of the nation's ambient air quality monitoring systems (before and after NCore) is still somewhat confusing. I think it will be helpful to describe the landscape of the nation's monitoring systems before and after NCore, similar to the approach used in the EPA presentation dated July 2003 (http://www.epa.gov/ttn/amtic/files/ambient/pm25/casac/jul03pre.pdf), page 27 (slide 27) with further clarifications. Specifically, after NCore, what networks will still be in existence? It may be helpful to readers if the nomenclature in the presentation corresponds to the names of networks rather than "Core+PM Spec", "Core Spec", etc. Does everything on the "Future Directions" side of the slide belongs to NCore and there are other networks that will be coexist but not shown?

Response to Charge Question 3:

It sounds like a good idea.

Response to Charge Question 4:

The context of this question is about divesting "redundant monitors in adjacent, but separate, geopolitical areas". I think this approach is valid in principle; but there may be some practical issues to be worked out. Modeled pollutant concentrations are used in various regulatory processes from SIP demonstrations to permitting. Particularly in permitting, modeled concentrations are used heavily as the basis for regulatory decisions regardless of the geopolitical boundary. Some of these permitting decisions bear important economical, political, and legal implications. In my opinion, air quality surfaces generated based on a network of well placed monitors are not only scientifically acceptable, they are better than using observed data from individual monitor(s) to represent the air quality of the geopolitical area in which the monitor(s) are located.

There may be some practical issues to consider:

- How close should the monitors be to each other to be considered "adjacent" and therefore a candidate for divestment? EPA may establish some general guidelines to address this issue. This is also a function of uncertainty and reliability/confidence level of the model to be used in place of the actual monitors.
- If a monitor is to be divested, which side of the boundary should maintain the other monitor? How will that affect funding? Should the divesting side still contribute some financially if they rely on the other side to provide the data for their regulatory needs?

Additional General Comments:

Data Integration

There are significant ambient monitoring activities outside of the networks discussed in the Strategy. They include special studies funded by State or local agencies and ambient air monitoring programs funded by private industries as part of Beneficial Environmental Projects (BEP). For example, the Louisiana DEQ recently ordered sixteen facilities in the Baton Rouge ozone non-attainment area to monitor Total Non-Methane Organic Compounds (TNMOC) and speciated ozone precursors. The initial order requires each of the sixteen facilities to install four monitors, *i.e.*, 64 monitors. Although the final number of monitors may be less as a result of on-going negotiations, it will still represent a significant increase in spatial resolution in the area and the monitoring will go on for at least multiple years.

The data collected by these monitoring activities can be a very good complement to the NCore and other monitoring networks covered by the Strategy. The data from many of these monitoring programs are not captured in the EPA monitoring data system. The EPA should consider developing some mechanism to bring the monitoring data into the system. This will be a very cost effective way to improve the spatial and temporal coverage. The quality control of these monitoring systems may or may not be as rigorous as NCore network. This concern can be addressed by having code flags to indicate data

quality confidence level (e.g., a code for NCore, codes for certain types of privately funded monitors). In a data analysis, having a mixture of high and low quality data with high density spatial coverage is often better than having accurate but sparsely populated data.

Funding for Level 1 Sites

I agree with many AAMM Subcommittee members concerning the importance and funding of Level 1 sites. Reducing PAMS sites in some east and west coastal areas (but not in the Gulf Mexico coastal region where ozone problems require high spatial resolution PAMS data) to fund Level 1 sites seems to be a good idea. There may be another funding source (although I don't know how to make it work at this time). Based on my observations and experience, some monitoring programs required as BEP are not well thought-out. Sometimes the pollutants selected for monitoring are not critical. Companies implement the monitoring program almost just for the sake of spending money required by BEP elements of the settlement without too much concern as what will be monitored. As a result, the monitoring data have very low value. It will be interesting to investigate if there is an administrative mechanism to channel and aggregate this type of BEP funds to support Level sites.

Atmospheric Processes That Were Previously Masked by High Pollutant Concentrations

Another comment I have is also related to spatial resolution. As the ozone situation improves in some industrialized regions of the country, some previously less known factors that have impact in a small area become more salient (i.e., as the overall ozone level drops, some previously "buried" peaks will become visible. The ozone formation due to highly reactive VOC (HRVOC) in Houston and Baton Rouge in recent years is an example of such a condition. My concern is that the network spatial resolution may not be high enough if we don't take these factors into the consideration.

NOTICE

This report has been written as part of the activities of the Environmental Protection Agency's (EPA) Clean Air Scientific Advisory Committee (CASAC), a Federal advisory committee administratively located under the EPA Science Advisory Board Staff that is chartered to provide extramural scientific information and advice to the Administrator and other officials of the EPA. The CASAC is structured to provide balanced, expert assessment of scientific matters related to issue and problems facing the Agency. This report has not been reviewed for approval by the Agency and, hence, the contents of this report do not necessarily represent the views and policies of the EPA, nor of other agencies in the Executive Branch of the Federal government, nor does mention of trade names or commercial products constitute a recommendation for use. CASAC reports are posted on the SAB Web site at: http://www.epa.gov/sab.